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Vol. V. NEW YORK, JUNE 13, 1885. No. 24.

THE second chapter of Mr. Philip Atkinson's interesting series of articles on "Static Electricity" will be found in this number. It would be difficult for any one to give a more terse and lucid explanation of underlying principles treated, and his definitions are models of brevity and clearness. The article is most interesting reading.

THE "Inventories" Exhibition in London seems to be more prosperous than its predecessors, the "Healtheries" and the "Fisheries." The electric light, in conjunction with grand fountains in the grounds adjacent and colored glasses, is playing quite an important part in the attractions of the "Inventories."

NEWS comes from Boston that it is proposed to form a strong company there to build and equip an Edison station of not less than 10,000 lights capacity. This is as it should be. Boston offers a remarkably good field for the use of incandescent lamps. There are already about 3,500 in use in that city. It is said that the plan involves consolidation with the Merchants' Company, using Thomson-Houston arc lights, and that the new service will be in readiness before the fall.

IT is stated that the earnings of the Western Union Company increased $60,000 in April. The latest purchase or step toward control made by the company in acquiring rights over the lines of the Southern Company is thought to be a highly judicious move, and to have more points in its favor than can be urged for other actions of a like nature in the past.

OUR special correspondent's report of the proceedings of the telephone conference held in Boston this week will be read with deep interest by all concerned in the progress of telephony in this country. The important subject is so thoroughly covered in the correspondence that little is left for us to add editorially this week. We shall, however, have something to say next week, when we publish the remainder of the report.

LIGHTNING has been playing some queer pranks of late in addition to killing quite a number of persons throughout the country. Snatching a gold ring from a man's finger, making a straight bar out of it and standing it up on end in the mud is something decidedly new. Then, in addition to knocking out many other things it knocked out the time-honored belief that it never strikes twice in the same place, for it killed a Canadian named Bryan last week who had once before been struck by lightning. On Friday last the festive fluid took a flyer at the Washington monument, and "badly cracked" one of the cap-stones.

WE are called upon from time to time to record the appearance and début in actual service of "the youngest telegraph operator in the country." But it seems that the precocity and juvenility of expert telephonists is occasionally far more remarkable than that of the youngest telegrapher who ever startled the world by his easy perfection at the key. It is said, for instance, that Mr. Ally, manager of the telephone exchange at Lawrenceburg, Ind., has a son scarcely four years of age, who is thoroughly familiar with switch-boards and the instruments, and who, when he wants candy, gravely calls up the groceryman patronized by his family, and orders it. There is a reminder in this of the early display of genius in Pascal or Mozart, and we may therefore expect some notable developments in telephony from this unbreeched prodigy, long before he attains to years of manhood.

An exchange says that Dr. Gross, a German physicist, has made a curious experiment which is not easily explicable by known facts. He placed two electrodes of iron in a vessel of chloride of iron solution, and inserted a galvanometer in circuit, adjusting the current by the Poggendorf-DuBois-Raymond method. One of the iron electrodes was then surrounded by a magnetizing spiral through which a current was passed, and it was found that the galvanometer indicated a new current flowing from the electrode that was magnetized through the liquid to the electrode that was unmagnetized. The magnetized electrode was kept cool by circulation of cold water, and Dr. Gross does not think that the effect was thermo-electric. When the electrodes were placed in the plane of the axis of the vessel (in this case a tube) with their ends pointing to each other, the current was observed to flow through the cell from the non-magnetic to the magnetized electrode.

TAKING the average cost of unloading ten different kinds of freight, it has been found that it cost the railway companies as much to unload a ton as it did to haul the same 23 miles. The figures are for the commoner and more easily handled classes of freight; such as bags, barrels, grain and light boxes. Iron in bundles could be hauled forty miles for the cost of unloading. It has been repeatedly said, on good authority, that the cost of carrying a ton of goods from a truck across the sidewalk, in New York, is 50 cents. It appears from these figures that a wide and rich field lies open for inventors and practical men. In some instances where figures have been kept, it is found that the use of a hand crane alone reduces the cost 68 per cent. This shows that the margin for improvement is very great and the profits may be expected to be correspondingly large. In this country we may profitably learn many lessons in regard to the handling of goods by the study of foreign practice.

THE safety of gas was strikingly exemplified in St. Louis a few days ago. The works of the St. Louis Gas Company were the scene of an explosion that totally wrecked the gas meter, killed two men and injured a third seriously. More damage was done by that one explosion than has been caused by electric lighting for the whole of the last year. And, speaking of gas, we may call attention to the significant legal proceedings that have just been carried to a successful issue by the gas companies in London, by which the vestries are practically enjoined from the use of steam rollers in paving the roadways. The companies produced a large quantity of evidence to show that whenever the roller was used their mains were broken. Several of the London newspapers and critical journals, above any suspicion of bias, complain bitterly of this decision. To us the alternatives appear very plain—gas and bad roads, or electric light and good roads. Every one who is accustomed to traveling around large cities knows that the steam roller is too valuable an adjunct of the best paving systems to be thrown into the waste heap at the word of the gas companies.

A FEW words of advice to inventors, if heeded, would save an immense amount of useless labor. If inventive talent could be turned in proper directions, valuable inventions might be made and the inventors reap some reward for their expenditure of time and money. Corn-planters and car-couplers have been invented by the thousand. The Patent Office and the country are full of them. No inventor need hope to make any money from an automatic car coupler even though it be "perfectly safe," "simple" and "not liable to get out of order." The roads do not want any coupler, and if a new one is adopted it will be pushed forward by some powerful combination. Against such a combination no man can hope to prevail by means of a good invention, no matter how perfect it may be. It is well for all inventors to follow Captain Ericsson's advice in these matters. He said that when he found a large number of men had bestowed thought and labor on a certain line of invention he concluded it was useless for him to surpass them and he therefore turned his attention to other matters. Inventors should not try to invent in the same line as thousands of others. They should also bear in mind that the thing which is easily invented seldom has a high market value.

SOME telephone employés were caught stringing wire in Chicago the other day, and fined one hundred dollars each. If the electric companies are tempted, while ostensibly engaged in the repair of wires already up, to "sneak" additional wires, it is the city's fault, and due entirely to the restriction placed upon the companies in this respect. With an ordinance compelling you to go underground, and a council which practically refuses to allow you to do so, it is hard to see a way out, except by the overhead route, and this, at an expense of hundred dollar fines for each employé, is a pretty costly route. It is possible that these troubles are at end, however, for there is a scheme on foot which, if carried through, will result in an arrangement with the conduit company by which the principal electric companies will secure the use of conduits wherever required. The idea, as we understand it, is to extend the conduits on all the desirable streets, and then relieve the electric companies from the necessity of dealing directly with the city officials, leaving this part of the work to be done by the conduit company for all. Such an arrangement, or any other which would relieve the companies of the restrictions under which they now labor, would give a wonderful impetus to electric lighting there. As the matter now stands the companies are forbidden to string wires overhead, and are required to put them under ground. But to do this latter they must have a permit from the city, and to get this permit is something which no man acquainted with the difficulties in his way would have the hardihood to undertake single handed. It is certainly to be hoped that some satisfactory arrangement will be the outcome of the present negotiations.

IF inventors wish to attack a problem which needs solution, it is easy to find one for them. Draftsmen really need a paper which will not expand and contract under the influence of heat and moisture. It need not be waterproof, in the ordinary sense of the word, for it must take India ink and water colors in the usual manner. To be of the greatest value it should not expand and contract; in this respect it should be equal to wood taken lengthwise of the grain. As at present made, paper is a most unsatisfactory material for accurate drawings. It not only expands and contracts with the changes of the weather, but from day to day and from hour to hour. Ordinary writing paper saturated with water will expand from less than one to almost two per cent., according to peculiarities of manufacture. If unequally dampened, the sheet is pulled out of shape, and so distorts a large drawing. Chemistry should be able to give us a remedy which would make the fibres of the paper impervious to the action of damp. A paper which will not cockle under the action of water can be used for a thousand purposes in the arts, provided, of course, the price is not too great. It is safe to say that a fortune will be realized from the manufacture of a non-cockling paper at a reasonable price, even though it be not otherwise waterproof. Starch paste is almost the only thing which will make the draftsman independent of the expansion and contraction of his drawing paper. By using it to paste his paper flat upon his board and spreading it over the whole surface he can keep the sheet where he wants it while the drawing is being made. Unfortunately, though the board and paste will hold the paper flat while in contact, the paper resumes its evil ways as soon as the paper knife or ruler has lifted it from the restraint of the board and the starch. It is no small advantage to be able to hold it in place even for a short time. The starch is not sufficiently adhesive to make the task of removing a stiff or strong paper difficult.

The Boston Telephone Conference.

[*From Our Special Correspondent.*]

HOTEL VENDOME, BOSTON, MASS., JUNE 8, 1885.—The telephone conference, upon which the thoughts of so many in the business have been fixed lately, to the exclusion of almost every other subject, is at last in session, and the interest displayed in the meetings by the conferees shows that they have a keen realization of the important fact that a new departure is to be taken from this time.

As has already been stated in the columns of THE ELECTRICAL WORLD, this conference meets at the special invitation of the parent American Bell Telephone Company. The notifications sent out from the Boston office were in circular form, *i. e.*, a type-written letter was used, in which the name of the person whose attendance was desired had been inserted. The letter stated that as there were various live questions, interesting alike to the parent and sub-companies, demanding settlement, it was thought appropriate to hold a conference at this place during the present week, from the 8th to the 13th. Should the sub-company accept the invitation, its representative would, on arrival in Boston, become the guest of the American Bell Company, which offered also to pay fares one way.

That this invitation should meet with ready acceptance, was no more than could be expected. The recent legislation of a "strike" nature in some of the States, the pressure on some of the smaller exchanges from the reduction of business, owing to general depression in trade and commerce; the strained relations, in some instances, between licensor and licensee, and the general feeling that if some of the load were lifted from the sub-companies more money might be made all round: these and other considerations led to the hearty approval everywhere of the idea of holding a conference. It was felt as well by those who had failed to attend previous conventions as by those who know how much good is derived from the rubbing of mind against mind and the comparison of experiences, that in every respect the opportunity thus presented on the initiative of the Bell Company must be made the most of.

Some of the delegates arrived as early as Saturday last, others drifted in during Sunday, but the majority made their way to this ornate Vendome, in the aristocratic region of the Back Bay, on Monday morning. Mr. Vail was here early that day to give a cordial welcome to the company's guests, and he expressed himself as firmly convinced of the great benefit to be derived from consultation—and concession. In regard to the private character of the meeting, he said that where vital issues came up for discussion, the tongues of many men whose opinions were wanted would be tied by the fear that their remarks would go out to the world in all their fullness of unrehearsed and rough detail, and that injury might also be done to the best interests they sought to serve. Hence the desire of the company to hold the conference within closed doors, not so much for its own sake as for that of its guests. Letting this view of or argument against publicity go for what it is worth, it may be said that a jollier or freer set of men never met in solemn, secret session.

It had been intended to open the ball on Monday morning, but several of the members of the conference had not yet recovered from the fatigues of the journey, and others who had braced up disappeared suddenly from the scene as soon as the whistle of a distant calliope announced the passing of the pageant of another gentleman, widely known as the owner of a "white elephant," and who, unlike themselves, contrives to make money out of that peculiar possession. In fact, it was not until lunch time that the gathering in the halls and on the stoop of the Vendome at all came up to the list of guests who had sent word of their intention to be present, and thus the morning hours were lost.

However, about 2:30 P. M. the delegates assembled in the banqueting room of the hotel, and the muster was certainly a notable one. It was difficult to think of or to name any representative man now actively and prominently connected with the businesswho was not in attendance. The names of those present are as follows: Mr. W. H. Forbes, president of the American Bell Company; Mr. T. N. Vail, general manager; Mr. E. O. Madden, secretary; Mr. C. P. Bowditch, vice-president; Messrs. W. H. Eckert, New York; J. P. Davis, New York; C. F. Cutler, New York; W. D. Sargent, Brooklyn; Morris F. Tyler, New Haven; H. P. Frost, New Haven; J. W. Duxbury, Providence; Col. C. H. Haskins, Milwaukee; H. Metzger, D. L. Wilson, Pittsburgh; E. B. Field, Denver; Dr. S. M. Piush, Philadelphia; G. F. Durant, St. Louis; A. S. Hibbard, Milwaukee; G. L. Phillips, Dayton; E. J. Hall, Jr., New York; T. B. Doolittle, Bridgeport; C. R. Truax, New York; H. L. Storke, New York; J. J. Dickey, Omaha; Flemon Drake, Omaha; J. R. Mulvane, Topeka; J. M. Brown, Boston; W. N. Eastabrook, Elmira, N. Y.; S. M. Bryan, Washington; D. H. Louderback, Chicago; F. G. Beach, Chicago; A. F. Cutler, Davenport, Ia.; G. N. Bigelow, Milwaukee; W. A. Jackson, Detroit; B. E. Sunny, Chicago; J. S. Forbes, New Orleans; A. B. Uline, Albany; D. A. Smith, Auburn; T. B. Bailey, A. B. T. Co.; R. M. Bailey, Williamsport, Pa.; R. O'Brien, F. J. Wood, Utica; C. A. Nicholson, Utica, N. Y.; C. Jay French, Chicago; P. J. Marrs, Nashville; Col. G. N. Stone, Cincinnati; E. V. Cherry, Cincinnati; J. N. Keller; A. C. White, Providence; Wm. Ker, Harrisburg, Pa.; T. R. Shellenberger, Hamburg; T. Ivers, New Bedford; F. W. Harrington, N. Y. City.

The list of those expected to be in attendance, or who are putting in an appearance since the above was compiled, is: Messrs. J. P. McKinstry, D. I. Carson, Moses Hatch, J. B. Speed, James Merrihew, Col. R. C. Clowry, A. D. Bullock, H. R. Rhoades, W. A. Leary, H. N. Gifford, E. T. Babcock, Jr., R. S. Boyd.

It will be noticed that the number is just about as large as that already given in the WORLD.

Messrs. T. D. Lockwood, W. B. Van Size and Dr. Jaques were also present on behalf of the Bell Company.

The meeting was called to order by Mr. Forbes, and the conference thereupon proceeded to make Col. C. H. Haskins chairman, and Mr. E. J. Hall, Jr., secretary. The hall in which the talking is done does not seem particularly well adapted for its purpose, and the arrangements did not give satisfaction. They have now been changed, so that members occupy chairs ranged semi-circularly round a long table, at which the officers of the meeting and those of the company sit. The "closed" doors are mostly open, but are vigilantly watched by one of the attendants from the down-town Bell offices.

As if to put the conference in a good humor, and thus to confirm the favorable impressions already engendered by its lavish hospitality, the first step of the company was to lay before it a letter strictly "private and confidential" from Mr. Vail, in which the announcement was made of contemplated reductions in the royalty to be paid to the company on sets of instruments. It had been recognized that to many of the smaller exchanges, and, in fact, to a large proportion of the business done in various portions of New England, in the Central Union territory, in some Southern regions, but not specially that around New York, speedy extinction must come if the royalty was not made to bear some closer and more reasonable relation to the earning capacity of the apparatus when used by subscribers in a small way of trade or manufacture; and hence a modification of the old scale was inevitable if any improvement was to be arrived at. Mr. Vail's letter therefore made the concession required by the necessities of the case, though not in the shape, nor to the extent, sought for and expected by some of the gentlemen present, who think that the business all round must be helped by an alleviation of the burdens imposed in patent royalties. The Bell people say that they have no data on hand to show just how far the contemplated reductions will cut down income or to what degree the output of sets of instruments will be increased, but it may be surmised that the matter has been very carefully gone into by the executive committee of the company. It would not be true to say that the voice of grumbling or the accents of disappointment have not been heard, loud or in deep murmurs, since the announcement was made; but the general feeling is that the action is to be taken as one expressive of the new and more liberal policy that will rule in the Bell councils; and that, after all, one must be thankful in such a case for what one can get. New England will perhaps be able to benefit largely, with others, from the new basis of low royalties.

I shall probably have more to say on this point later on, as the yet undefined programme develops and the views of those present find maturer expression. The afternoon session was remarkably short, lasting barely from 3 until 4. The important subject of handling telegrams was considered, including the limitation of business to the Western Union by contract. One of the speakers, Mr. Marrs, of Nashville, gave some remarkable figures, showing how large a business of this nature could be worked up if proper care was given, as opposed to the views of some who do not think it worth bothering with, and who have not yet developed it to any extent. A little was said on a few points of exchange management by Messrs. Durant, Hibbard, Sargent, Haskins and one or two more, and then the meeting adjourned until 10 A. M. Tuesday.

Among those who were here during the day were: Mr. Eugene L. Phillips, Mr. Fisher, of the Detroit Electrical Works; the ubiquitous Mr. Fred. Angell, and others, without whose aid no well-conducted telephone exchange or territory can be kept up to the right point of efficiency. Mr. J. M. Oram was also to be seen explaining time-telephony. It need hardly be said that the chance of renewing old acquaintanceships was welcomed with avidity, some of the delegates not having seen each other since the convention in Boston of 1882, when, as now, the Bell Company showed that it knew just as well how to play the part of a generous host as to "drive a trade," and protect its interests from whatever quarter threatened.

JUNE 9.—The fact that the parent company had actually offered a new basis of operation that would within certain limits enable them to work on an extended plan, and to serve individuals and families in residential districts or thinly settled localities so as to clear a little profit, has filled the breasts of many with a sober joy. One of the members of the conference has described to me the plan on which he proposes to start out in a certain locality when he reaches his home in a State not far from New York. He thinks that he can build up a business there, although little has been done hitherto, at the rental of $3 or $4 per month; and, by putting as many on a line as it will carry, he hopes to make a good showing. He is perhaps one of the most sanguine with whom I have spoken on the subject. It is, however, interesting to note how great a fear is entertained by many lest on learning that a lower royalty is to be exacted by the parent company, the subscribers in their territories shall jump at the conclusion that a reduction in rates can be made all round, and shall demand a rental so low as to rub all the gilt off Mr. Vail's new gingerbread.

The session was resumed on Tuesday morning, between 10 and 11, when the members, with grip and password, were ushered to their seats in the council chamber. An arrangement of seats differing from that of Monday was adopted. It was discovered that the discussion could not be carried on in a sufficiently low tone of voice when the seats were ranged in rows down the long room, and so, as I think I have already stated, they were placed semi-circularly so close together that an ordinary whisper could be heard by all the fifty present. A microphone of new pattern was handy for members who were at all afflicted with deafness. I may mention that the password was "146," that being the number of a room where liquid refreshment and good fellowship could be found at any hour of the day or night.

During the forenoon, notes were compared as to the management of exchanges, and as to the innumerable details of construction and maintenance, house-top privileges and the like. The New York exchanges of the Metropolitan Company are naturally those from which the most instructive experience can be gained, and thus Mr. W. H. Eckert found himself running the gauntlet of a great number of questions dealing with the points that had come under his observation, and about which there was great anxiety on the part of all to know more. The objection to the system of torture to which Mr. Eckert was subjected is that the questions are not consecutive on the same subject, and that the thoughts of speaker and listener are kept hopping from twig to twig of the tree of knowledge in a very unprofitable way. Still Mr. Eckert survived the ordeal, and contrived, in spite of the manner in which he was pumped, to make public —"secret," I mean— a vast amount of very useful information, the fruits of which will ripen later. Mr. Sargent also entered considerably into matters of detail.

The various questions connected with underground wires came up in the afternoon, but have been so fully treated that I need not now go into details. It will cover the ground to say that, where they can have them, telephone managers prefer aërial wires. This may surprise many, but I "give it away" freely, as one of the *things* that should not be kept dark.

The burning question of the afternoon was "complimentary telephones." It is well known that every telephone set put out is not an earner. Many simply represent so much dead loss in one way, though as they can be judiciously used where they will do most good, their function is highly beneficial to the general interests of the exchange. Newspaper offices often require a telephone, and if the service is good they will know it. Then there are members of city governments and "boss" politicians, with whom, in order to explain the merits of their case in emergencies, it is desirable that there should be prompt communication of the kind that the telephone affords. In some exchanges, too, spare sets are kept on hand, so that damage or deficiency may be met. All these points and many others were brought out in the session, and there was evident a great anxiety on the part of the delegates to be helped by the Bell Company to meet the "deadhead" requirements of its licensees. The percentage that should be conceded was variously suggested, very few of the gentlemen feeling that they could follow the courageous example of Mr. Uline, of Albany, who stated that when such people wanted a telephone in his section he put it in, and did not fail to render a bill later. The outcome of the discussion, with bated breath, of this vital topic, is, I am given to understand, that the cases will all be treated on their merits, that each sub-company's representative will settle the matter for it individually. They may not get 5 per cent. or even 1 in 25, but what they do get will no doubt be accompanied by some very excellent and shrewd advice from headquarters as to the manner in which parties should be dealt with. I may be wrong, but there appears to be abundant material for reflection in this move, under some of its aspects. A man with a liberal allowance of complimentary telephones ought, presumably, to be very happy.

The subject of adverse legislation came up, and Mr. F. G. Beach produced a copy of the Indiana law fixing a $3 per month rental. Of course the necessity of meeting this description of attack is keenly realized, and I do not believe that the outcome of the handling the subject has received here, throughout, will leave untried any feasible and practicable way of heading off legislative assailants or of fencing their vicious blows.

There was a good deal said about pay stations, of which more anon.

JUNE 10.—The business of the day has been quickly disposed of, and in the midst of so much junketing can be but briefly summarized. There was only one session, that of the morning, at which the provisions for maintaining

absolute secrecy were redoubled, and all mats were removed from the corridors after work began, so that the footsteps of would-be intruders might be more easily heard by the door keeper. Most of the time was given up to talk on extra-territorial lines by such well-posted and able men as Dr. Plush and Mr. A. S. Hibbard, of Milwaukee. Mr. Durant, of St. Louis, asked Mr. Jackson, of Detroit, what he could say about his efforts to avoid or kill induction. Mr. Jackson explained the principle and operation of his new reactionary coil, the purpose of which is to establish an equilibrium on the line, making disturbing currents react upon themselves, and thereby neutralize each other. As now constructed, it is an induction coil placed in the transmitter, occupying about twice the space of the ordinary induction coil, which it would practically replace, performing admirably all its functions, and in addition those of induction killing. Mr. Lockwood expressed an opinion favorable to the reactionary coil. Patents are granted, but have not yet been taken out, though they probably will be in a few weeks. It is also proposed to get patents abroad, hence it would be inadvisable to give fuller details in print. The device has been tried with success in Michigan, Ohio and elsewhere.

After lunch the whole Conference visited, on invitation of the New England company, the Boston Exchange, and then called upon Mr. Gilliland, and were greatly interested in his work and new appliances. They were then driven to see the Reservoir. The sight of that vast body of water was highly suggestive to not a few.

A trip will be taken down the harbor on Thursday.

Among those who were present to-day may be mentioned Mr. Clark B. Hotchkiss, the genial general agent of the Day Kerite cables; Messrs. Waring and Marsh, of the Standard Underground Cable Company; Mr. J. Chester Wilson, of the Clark Insulated Wire Company, and Mr. Gardner G. Hubbard, father-in-law of Professor Bell.

The Freeman Telephone.

Considerable interest has been manifested in telephone circles in the recent issuance of two patents to Mr. James P. Freeman, of Chicago. These embody respectively the method and apparatus transmitting articulate speech by *intermittent* electrical impulses accomplished by the use of a special form of battery transmitter. The theory that *continuous undulatory* currents are requisite for the transmission of articulate speech has been combated by many, and while intermittent current transmitters have been

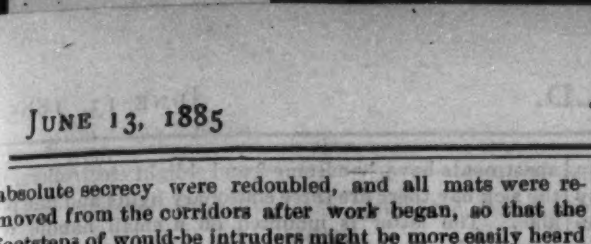


FIG. 2.—SECTION OF DOOR AND DIAPHRAGM.

constructed and operated they were generally found lacking in the power to transmit certain sounds. Numerous other methods have been tried to disprove the theory of the continuous current, one of the more recent being the interposition of a rapid make and break apparatus in a telephone circuit.

In the patents issued to Mr. Freeman there is described a form of telephone in which an instantaneous break occurs at each vibration of the diaphragm, but it is claimed that the rapidity of break and the construction of the instrument is such that all sounds are clearly transmitted.

In connection with the transmitter there is also used a special induction coil having two primaries and one secondary.

In the accompanying illustrations Fig. 1 is a view in elevation of the transmitter box with its door open to show the interior parts. Fig. 2 is a section of the door and diaphragm in the plane of the vertical diameter of the latter, the circuit closing and breaking devices and the induction coil. Fig. 3 is a detached end elevation of the working lever and electrodes. Fig. 4 is a longitudinal diametric section of a preferred form of induction coil.

The lettering being uniform in all the figures the connection will be easily traced.

In the apparatus the diaphragm *D* is mounted behind an orifice in the door in the usual manner.

From the centre of the rear surface of the diaphragm projects a pin *c*, and behind this pin is an approximately equal-armed rocking lever *F*, pivoted to an arm *f*, which stands behind the diaphragm and is supported by a post *f'*, projecting rearwardly from the door *A'*. This rocking lever *F* has inserted through openings in its ends insulating or non-conducting plugs *g g*, and through these plugs are secured metallic pins *h h'*, the forward ends of which are arranged to make contact with the tips of metallic spring-fingers *I I'*, which project from the door *A'* and stand at a little distance from the rear face of the diaphragm. The rear ends of the pins *h h'* are arranged to make contact with the respective carbon electrodes *K K'*, carried by metallic strip-spring *k k'* projecting from metallic spring-arms *l l'*, which project rearwardly from the door *A'*. Each of these spring-arms has behind it a post l^2, through which passes an adjusting-screw l^3, the tip of which bears against the arm. By means of these screws the arms may be adjusted to cause the springs to hold the carbon electrodes in proper relation to the contact-pins. These spring-fingers, spring-arms, electrodes, rocking lever, and contact-pins constitute, in connection with the diaphragm, the circuit closing and breaking device. In circuit with them there is placed the induction coil shown in Fig. 4. Here *m* and *m'* are the two independent primaries, which are connected respectively to the two sides of the rocking-lever arrangement; and between them is the secondary coil.

It will be noted in Fig. 3 that the pin *c*, at the centre of the diaphragm, touches the inner side of the rocking lever *F* at one side of its pivot and at a point nearer to pin *h'* than to pin *h*. The carbon electrode *K* is adjusted to bear normally but lightly on the inner end of pin *h*, and which

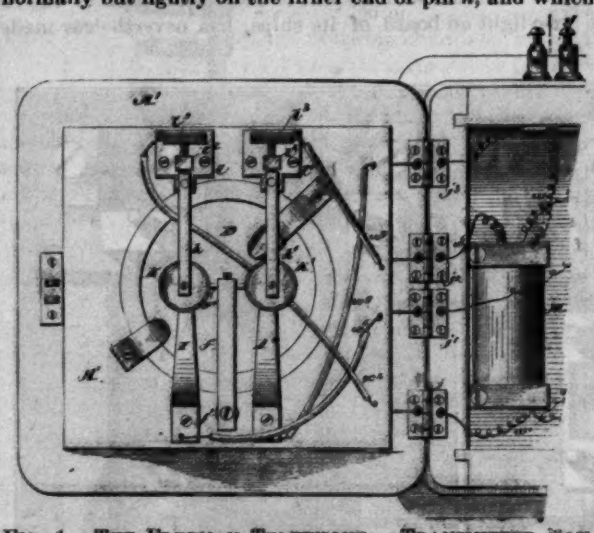


FIG. 1.—THE FREEMAN TELEPHONE: TRANSMITTER BOX.

pin is always in contact with the spring-finger *I*. The circuit of the battery *X* is thus normally closed through the outer primary coil of the induction-coil. At this time pin *h'* is in contact with spring-finger *I'* and just out of contact with carbon electrode *K'*. Now, if the diaphragm makes an inward half-vibration it moves the rocking lever *F* to force the pin *h'* into contact with carbon electrode *K'* and break the contact of pin *h* with carbon electrode *K*, thus breaking the circuit of the outer primary coil. As the spring-finger *I'* follows pin *h'* and never breaks contact therewith, the circuit is closed through the inner primary coil as soon as the latter pin touches the carbon electrode *K'*, which is immediately after the breaking of the contact between pin *h* and carbon *K*. Both the closing of one and the breaking of the other produce inductive effects upon the secondary, and the winding or direction of current in the two primaries is such that the breaking of one induces a current in the same direction as does the closing of the other, and their combined effect is to induce in the secondary very powerful impulses, which flow on the connected line and actuate the receiving instruments included therein. The outer half-vibration of the diaphragm of course restores the parts to their normal position, breaking one circuit and closing the other.

Several modifications of this form are also shown, but they do not differ materially from the one just described.

Mr. Freeman claims that his apparatus is able to transmit all speech loudly and clearly, with a break at each vibration of the diaphragm.

An Electric Steering Apparatus.

Our readers will recall the short item which appeared in one of our issues a few weeks ago relative to an invention by means of which a ship once set to its proper course would be maintained so automatically. We are now enabled to give a more definite description of the apparatus,

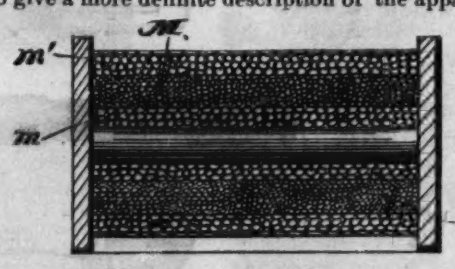


FIG. 4.—INDUCTION COIL.

which will, no doubt, interest our readers, and especially so since a new principle is said to be involved in its operation.

The invention, briefly stated, consists in causing the compass needle of a ship to close an electric circuit whenever the ship deviates from her course, the closing of the circuit actuating the steering gear, and bringing the ship back to its true course. This evidently brings an electric current in direct proximity to the needle, which would ordinarily make such a disposition impracticable. But Mr. C. H. Washburn, the inventor, claims to have discovered a method by which all disturbing influence of the current is removed. He states that the application of electricity in proximity to the compass needle is in strict accordance with the conditions of a law of currents discovered by him. He further states that it is possible to pass a current *through* the needle sufficiently strong to melt it, without causing a deflection. This statement may justly appear difficult of credence to many and appears so to ourselves, but we must confess that the apparatus which we saw in operation apparently fulfilled the conditions, notwithstanding the fact of the needle closing a circuit of 10 Leclanché cells, the current of which passed in close proximity to it.

The apparatus itself is quite simple, and presents no mechanical difficulties whatever. Upon the needle is mounted an upright pin which plays between two contacts, either of which closes the circuit, according to the direction in which the ship deviates from her course. The closing of the circuit actuates a small valve which admits pressure to the corresponding side of a small cylinder and piston. This in its turn actuates the valve controlling the pressure to a large cylinder and piston, to the latter of which the rudder chains are attached. Thus the slightest deviation causes the rudder to be turned so that the helmsman can, to all intents and purposes, be dispensed with.

As yet the invention has not been tried on board ship, but the government has taken the initiative in the matter, and within a few weeks the new steering apparatus will be placed on board the U. S. ship "Dispatch," where it will undergo a practical test.

The installation will be so arranged that the steering gear will be controllable from different parts of the vessel, since the mere turn of a switch, by closing the circuit, will bring the ship about independently of the compass needle. In addition, a bell placed in the captain's cabin will sound whenever the ship deviates, and will be a constant informer of the ship's course.

We await with considerable interest the outcome of the trial. The great importance of the invention is manifest, and its successful issue would no doubt work a great change in the handling of ships, making them not only safer but reducing the time and expense caused by bad steering on voyages. A number of other advantages will suggest themselves, but these alone will suffice to show the far-reaching character of the invention.

Regarding the principle upon which the apparatus works, as well as its exact construction, we can give no further information, as the former is a secret with the inventor, while the latter is not yet sufficiently protected by patents.

The Shape of Infernal Machines.

It was stated recently that infernal machines of new shape and construction were being carried into England by dynamiters. Some of these machines are provided with three springs, and it is said to be necessary for only one to

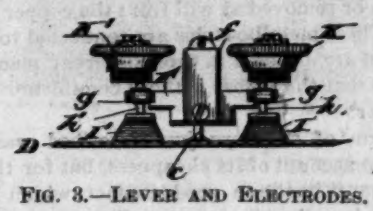
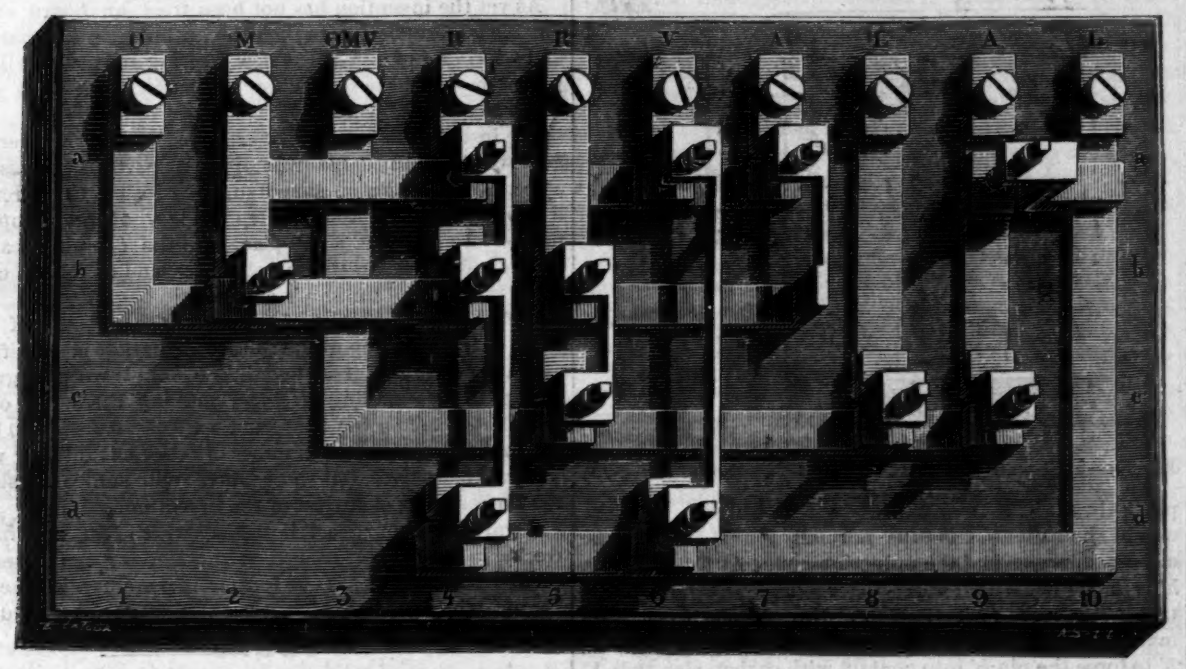


FIG. 3.—LEVER AND ELECTRODES.

go off to cause an explosion. A recent English writer on the subject says of the machines that, as a rule, they look harmless enough, one of them even assuming the innocent semblance of an ordinary lump of coal. The imitation is so good that it is only on taking it in the hand that the supposed coal is found to be in reality metal, hollow, but of great weight and substance. This singular article was brought to the police by one Fraser Palmer, otherwise Farrell, otherwise "Warhawk," a man who had a mania for warning European governments of plots which in reality had no existence save in his own imagination. He asserted that this supposed piece of coal, with others of the same kind, was intended to be charged with explosives, and mixed with the genuine coal in the bunkers of some doomed steamship. It is said that, in consequence of his revelations, an examination was made of the whole of the coal in the bunkers of the late Czar's steam yacht "Livadia," then lying at Glasgow, but without result. Side by side with this last item is a far more formidable-looking affair. It is of small size, but the solidity of its construction and the peculiarity of its shape—a flattened oval, tapering down at the extremity, where the fuse is inserted—indicate that special thought and ingenuity have been expended on its design. Even the most accomplished of criminals, however, cannot be always on his guard, and this deadly contrivance was inadvertently left in a tram car. The conductor was persuaded that his "find" was an infernal machine of more than ordinary diabolical character, and he conveyed it, with infinite precaution, to the police, who at first were of the same opinion. Further investigation, however, satisfied them that the supposed explosive was merely a model, artistically cast in lead, of a new design for an infants' nursing bottle. A curious incident was reported from London the other day, showing how little familiar the officials and police yet are with the applications of science and how quick they are to believe that any kind of machinery may be "infernal." Two German gentlemen arrived in that city with an electric lamp which they intended to show to the chief of the Metropolitan Fire Brigade. When they were searched at the Custom House, the lamp was found and was at once thought to be an infernal machine. The two Germans were put very unceremoniously in durance vile, and the lamp was sent very carefully to Woolwich for inspection by Col. Majendie. Explanations and apologies came later.

A Universal Switch-Board.

In electrical laboratories, where different instruments are used successively for the various determinations, the expenditure of labor and time is considerably reduced by having a switch-board so arranged that the desired changes can be conveniently made. A very ingenious form of apparatus was devised by Dr. Kittler, of Darmstadt, in connection with the celebrated electric tests of incandescent lamps at Munich in 1882. This arrangement has been somewhat modified since then, and now presents the appearance illustrated in the annexed engraving, for which we are indebted to *La Lumière Electrique*. As will be seen, the top of the board has ten binding-posts, to which the wires leading to the various instruments are permanently connected. These are never disturbed. There are



A UNIVERSAL SWITCH-BOARD.

also twelve contact keys, the screws of which can be raised and lowered by means of a socket-wrench of insulating material. Thus the keys can be brought into contact with or removed at will from the copper strips below them. These metallic strips are connected to the binding-posts, and are disposed in three different planes above the board, so that they cross without coming into contact with each other.

The form of the keys just described was chosen not merely on account of its cheapness, but for the additional reason that it insures a good contact, which is evidently necessary in such experiments. The operation would be more rapid if each key were provided with a handle, but it would not be so certain, and besides the space occupied would be greater. The commutator shown occupies a space of 12 by 16 inches. In order to avoid sparking at the breaking of contacts and to insure the continuity of the light, care must be taken to make and break contact in proper order. A little practice will enable the operator to find the latter easily. In electrical laboratories the machine would be stopped during the operation of changing the contact keys. This stopping, however, would be generally required to measure the resistance of the machine while hot. Besides this, the manipulation could be simplified for students, by providing the keys with paper indicators, on which are directions as to the proper keys to be depressed for the various connections.

As shown, the contact screws are placed in vertical lines and numbered from 1 to 10 and lettered. These letters correspond to the connections which they form and which are as follows:

O = Wheatstone bridge.
M = dynamo.
V = voltmeter.
A = ampèremeter.
R = rheostat through which the current of the machine tested can be sent.
L = lamp circuit.

Accordingly, the conductors coming from the Wheatstone bridge (which should be as large as possible), are connected at *O O* (1 and 3); the dynamo machine at *M M* (2 and 3); the voltmeter at *V V* (3 and 6); the rheostat wires, of large size, at *R R* (4 and 5); the ampèremeter at *A A* (7 and 9); finally at *L L* (8 and 10) are connected the wires leading to the dark room, in which the photometer is situated, and in the circuit of which the lamps to be tested are placed. It will be seen that, with one exception, the binding-posts receive but one wire each. The third binding post receives three, and it is well to introduce there a single large conductor to which the three branches are soldered, which lead to their respective points.

It is evident that several instruments can be placed in derivation in the voltmeter circuit for the purpose of standardizing or for checking the readings. And in like manner several ampèremeters can be placed in series in the ampèremeter circuit.

It will be seen that by depressing the proper keys any one of the terminals can be placed in connection with any other, so that a ready means is afforded for making successive determinations. A large number of different combinations can be made by connecting the different instruments for the purposes of measurement, standardizing or checking. In every case the wires leading to the instruments remain fixed to the binding posts, thus obviating the necessity of constant change, which is sometimes attended with danger.

The Electric Light on Board the U. S. Ship "Omaha."

The United States government, although not as progressive as others with respect to the introduction of the electric light on board of its ships, has nevertheless made a beginning, and several ships are already fitted up with it. The intention of the naval authorities to continue this practice is evidenced by the fact that every new ship now in course of construction has an electric light plant contracted for.

Among the older ships fitted up is the "Omaha," which has been equipped on the Sawyer-Man system by the Consolidated Electric Light Company. We inspected recently the installation on board the vessel, which is now lying in New York Harbor, and found that, although the conditions had been very trying, the work had been done in the most satisfactory manner.

The installation on board the "Omaha" consists of 135 lamps, the dynamo being a 100-light machine, run by an Armington & Sims engine. The wires are divided up into nine circuits as follows: 1, spar-deck, forward; 2, spar-deck, aft; 3, berth-deck, starboard, forward; 4, berth-deck, port, forward; 5, berth-deck, port, aft; 6, berth-deck, starboard, aft; 7, hold, forward; 8, hold, aft; 9, engine, fire-room and shaft alley. The switch-board in the dynamo room is divided, half being on the starboard and half on the port side. On each switch-board is mounted a double pole safety-fuse for each circuit. Thus by having the switches and safety-fuses in the dynamo room, the man in charge has perfect control over all the circuits.

In addition every fixture has a safety-fuse as usual. The fixtures in hold, orlops, storerooms and the sailors' quarters have strong wire guards to protect them. The staterooms have swinging brackets capable of three different movements, so that the light may be placed at any angle or in any position. The dining rooms and the captain's apartments have handsome 3 and 4-light electroliers. In the sick bay there are three stationary lights and one portable. The latter is mounted on a small handle with guard and with flexible cable attached, so that it may be carried to any part of the room during surgical operations. The doctor's stateroom is provided with a similar arrangement. A small hook is screwed in the end of the lamp and a number of small brass eyes are screwed into the ceiling, affording means by which the light can be fixed in any part of the room at will.

The fire-room gave the most trouble, as in order to place the fixtures in the best position each one had to have a special casting for a support. On deck also six portable lanterns are placed, which can be carried for a distance of 40 feet from the connecting boxes. The running lights, peak, stay and deck lanterns, are the old oil fixtures refitted for electric lights. The running lights are portable, with cable connection to small water-proof connection boxes. The mast-head light has two circuits, one being extra, in case of accident. All of the running lights have two lamps each. The wire throughout the ship is lead-covered, except where it runs through the fixtures; there silk-covered cable is used. Considerable trouble was experienced in wiring the ship. The boring through "knees," etc., of live oak averaged about one hole to every six feet of wire, and the average thickness was about 10 inches of wood. In almost every case special augers had to be made. The wires could have been led around the knees and beams, but the chances are that they would be knocked or worn off within six months: and hence boring was wisely resorted to.

We may add that the fixtures were furnished by the government from designs made at Washington. Some of them are open to considerable improvements which will soon be made upon them.

The officers of the vessel speak very highly of their new light, which was installed under the personal care and direction of Mr. Bernard, of the Consolidated Company. Our own observation of the manner in which the work has been done enables us to speak most highly of its intelligent, systematic and thorough execution. Ship-lighting is a department presenting many serious difficulties unknown ashore, and when the vessel happens to be a man-of-war going on a three years' cruise, the problems coming up for settlement are more than ordinarily formidable. However great the task, it has evidently been met to the entire satisfaction of the officers on board and of the naval authorities at Washington.

The "Criado" Electric Illuminator.

It is evident that our manufacturers of electrical goods need only to be given a hint of an existing want in order to fill the demand. We have thus already described several electric illuminators for dental and surgical examinations, each of which has its own peculiar merits and method of construction.

The instrument we illustrate to-day is constructed with special reference to compactness and ease of handling. Fig. 1 shows it in very nearly its true size, fully mounted

FIG. 1.

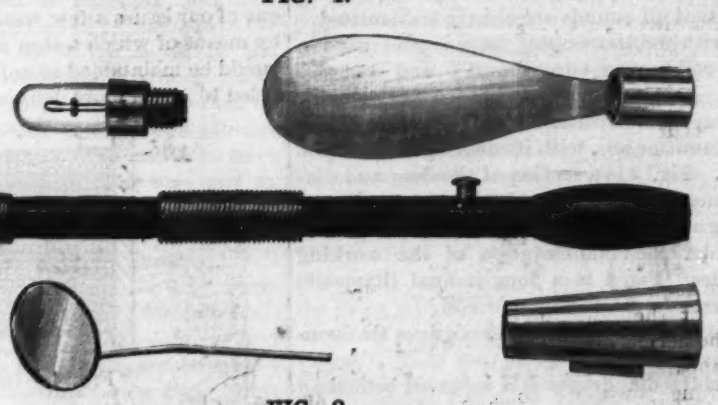


FIG. 2.

THE "CRIADO" ELECTRIC ILLUMINATOR.

and ready for work. It consists of a polished, hard rubber handle, 5¼ inches long, with a tongue depressor, lamp shade and a laryngoscopic mirror, and having an Edison lamp mounted in the end. All parts except the rubber handle are silver plated. Fig. 2 shows the different parts of the illuminator, all of which, it will be seen, screw on.

The lamp also is mounted on a screw socket, and may be taken out and replaced very easily. Connection is made with the battery by means of a flexible wire having a plug which fits into the lower end of the illuminator. The small knob projecting from the side of the handle is a key by which the circuit can be made and interrupted at will, with corresponding effect on the lamp. This instrument, which is made by Messrs. Stout, Meadowcroft & Co., of this city, is very handy and occupies a small space.

The Weston Regulator and Indicator for Central Stations.

In isolated installations where a limited number of lamps are constantly burning and the circuits are protected and easy of supervision, an indicator for showing the status of the working of the apparatus is hardly necessary, while, as a rule, the single machine, if properly constructed, is capable of regulating itself to any change of condition.

FIG. 1.—WESTON REGULATOR, RHEOSTAT AND INDICATOR.

In central stations, however, where a large number of machines are employed in feeding a single circuit, prudence requires that some means be adopted for guarding both machines and lamps against any accident that may occur outside the station. Where wires are run overhead, a short circuit or a break can be looked for at any time, and its occurrence must be indicated and provided for immediately in order to avoid injury to the apparatus. This applies equally to both arc and incandescent lighting, and, in the latter case, an indicator is especially needed for the purpose of ascertaining when to put on or take off machines, according to the demand. In arc lighting from central stations the circuits are usually run a definite time, and although not required in the same degree, in this case an indicator is nevertheless necessary.

The most general method of compensating for the changes which occur in an electric circuit consists in adding or withdrawing resistances from it, and thus maintaining its operation constant.

The Weston system of lighting comprises a very ingenious regulator and indicator, the action of which is entirely automatic, as all such apparatus should be, and which operates so as to change the resistance of a circuit as indicated above, at the same time giving notice of any variation from the normal condition of working.

The complete apparatus is shown in Fig. 1, and consists of a box containing resistance coils, an indicator and alarm-bell, and a regulator at the top. The regulator now employed and described below differs from the one shown here in form only, its mode of action being identical, however.

Fig. 2 shows the box with the cover removed, exhibiting the resistance coils. These consist of German silver wire wound on boards, which are insulated from each other. The terminals of the wire wound on each board are connected to adjacent sections of the circular commutator above them, so that a contact lever passing over the latter brings the successive coils in action.

The contact lever just mentioned is part of the regulating apparatus, the latest form of which is shown in Fig. 3. The action of the latter is based upon the fact that an armature held by a retractile spring will always be kept in the same position before an electro-magnet when the same current passes through the latter. Any variation from the normal current will displace the armature, and it is the motion thus obtained that puts the correcting force in operation. In the illustration, *M* is the electro-magnet, before which the armature *m* is situated. The latter is pivoted at *s*, and carries the end of the lever *L*, the other end of which is connected with the retractile spring *S*. Any motion communicated to the armature will be transmitted to the horizontal lever *L*, and also to the vertical rod *l*, which is connected to it near the spring.

The actual work of turning the contact lever is performed by the revolving wheel *D*, which is kept in constant motion by a cord traveling in a groove on its circumference. This wheel is mounted on a spindle which passes through to the front and has a pin *F* mounted eccentrically upon it, as shown more clearly in Fig. 4. This eccentric pin fits snugly into the forked end of the lever *G*, which is mounted loosely on the shaft *H* between the two ratchet wheels. The upper end of lever *G* has two arms *g* and *g'* to which are pivoted respectively the pawls *P* and *P'*. As the pin *F* revolves with its shaft, it vibrates the lever *G* and imparts to the pawls a constant to-and-fro motion. The pawls gear with their respective ratchet wheels, the teeth of which are cut in opposite directions.

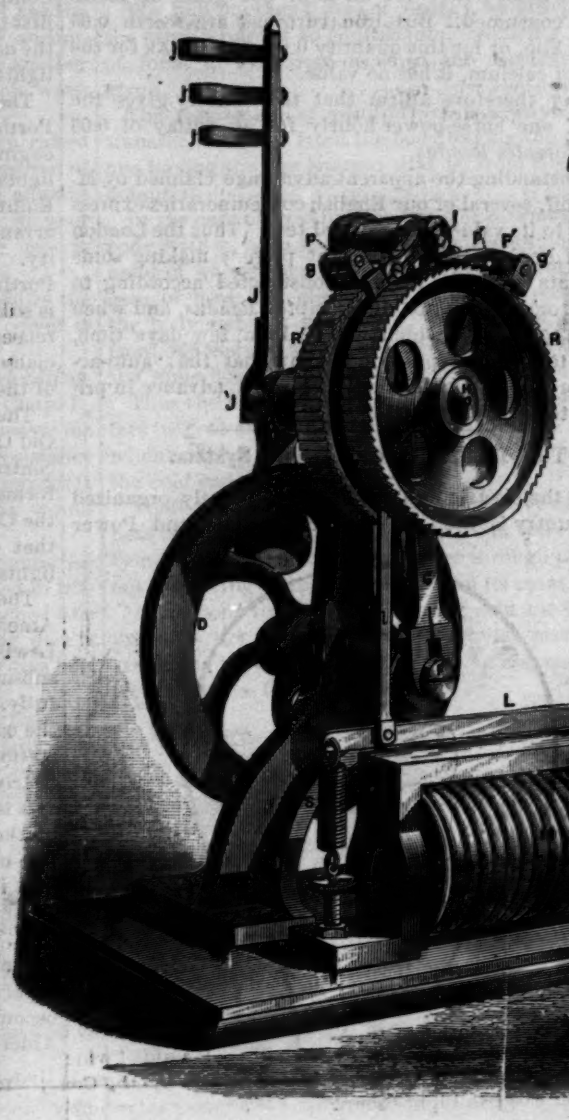


FIG. 3.—WESTON REGULATOR.

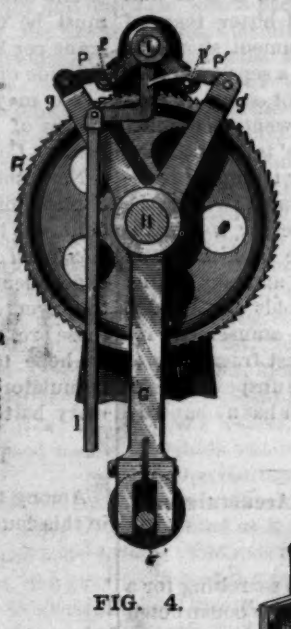


FIG. 4.

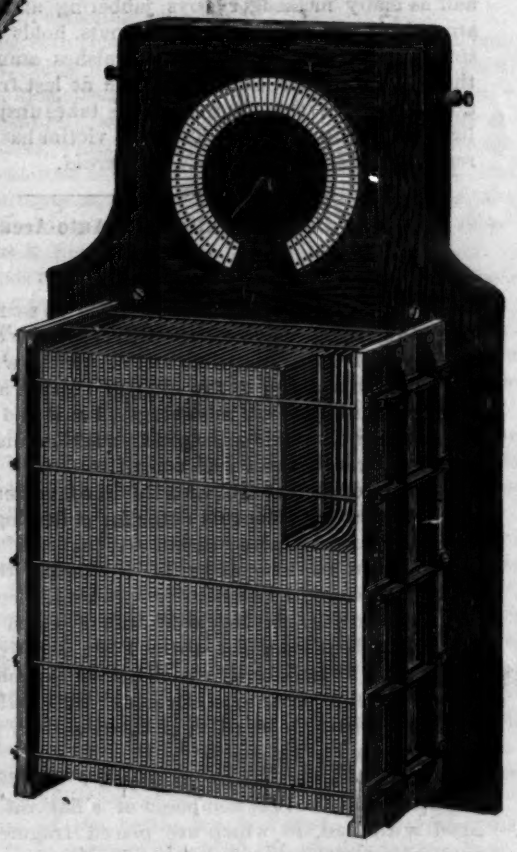


FIG. 2.—THE RHEOSTAT—INTERNAL CONSTRUCTION.

Returning to the vertical rod *l*, it will be seen to be connected at its upper end to a bell crank, from the hub of which two arms radiate. Upon the ends of these two arms are mounted the pins *p* and *p'*, which support the pawls *P* and *P'*.

The action of the apparatus is now apparent. When the current passing through the electro-magnet is normal, the armature will be attracted a certain distance. In this position the rod *l*, acting through the bell crank, maintains the pins in such a position that neither of the vibrating pawls can gear with the ratchet wheels. The moment the current through the electro-magnet increases or decreases, the rod *l* will be raised or lowered. Either motion lowers the corresponding pin and allows its pawl to drop into gear with one of the ratchet wheels, which revolves accordingly. Since the contact lever passing over the commutator sections is mounted on the same shaft as the wheels, it follows that any motion imparted to them is transmitted to the former. Thus an increase of current will cause the contact lever to travel in one direction, and a decrease in the other, by which resistances are introduced or cut out.

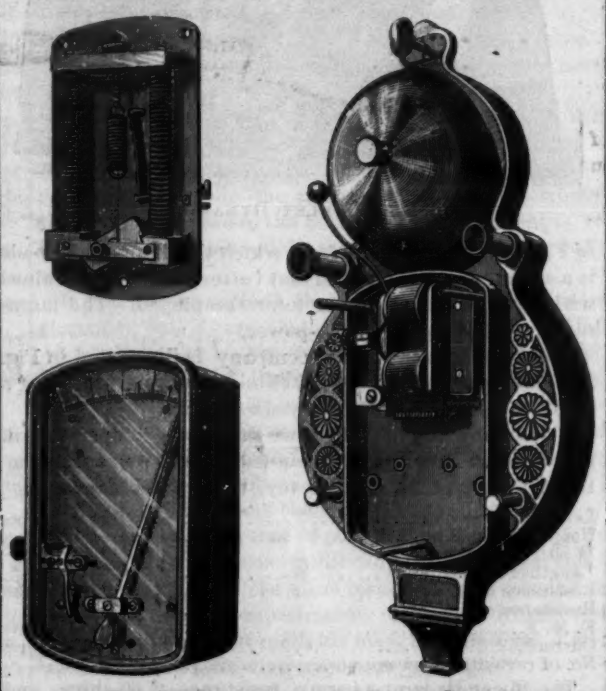


FIG. 5.—INDICATOR AND ALARM BELL.

It will also be observed that the contact lever is provided with three contact strips of different lengths. By this arrangement contact is made with one commutator section before leaving the one preceding; this avoids breaking the circuit as well as the consequent spark.

The indicator and alarm bell are shown in Fig. 5, which exhibits their interior construction. The operation of the former is identical in principle to that of the regulator. Here, too, an armature mounted on a spindle acts against a retractile spring. When the normal current passes through the coils of the horseshoe electro-magnet, the armature takes up a certain position, and the pointer attached to its spindle points to the centre of the scale. Any variation of current alters the position of the armature relatively to the two poles, and the pointer travels to the right or left of the centre, thus giving an indication of the character of the change. The bell is in circuit with a local battery; when the pointer is in its normal position this circuit is open, but the slightest deviation closes the local circuit and sounds the bell, which, however, stops the moment the proper conditions are re-established.

When the machine is not in operation, the pointer falls back and closes the local circuit, but in order to prevent waste of the battery the plug at the top of the bell is withdrawn, which again breaks the circuit and leaves it open while the machine is idle.

Although requiring a somewhat lengthy description, the action of the entire apparatus is instantaneous, the slightest disturbance causing the correcting, indicating and alarm mechanisms to be put in operation to restore the machine to its normal condition.

The apparatus is used in connection with both arc and incandescent light circuits. In both cases it is put in connection with the field circuit of the shunt machine and thus maintains the conditions constant with every change in the external circuit.

Bother with the Telephone.

New Yorkers are a long-suffering people. They have need to be. Practice makes perfect. They get more practice in the virtue of patience than a six-day roller skater

does exercise. There is one unnecessary evil that they have endured for a long time, and still they "kick" not. It is the inconvenience of the telephone offices about the city.

There is so much electricity in the atmosphere of New York, and such a perfect cobweb of electric wires criss-crossing the city in all directions, that at the best it is no easy matter to hear over the telephone. But in the public offices it never is at the best—it's at the worst, and the speaker and the listener are invariably put to a trial that would make a stony-hearted mule shed bitter tears of anguish. To hear well at all, the instrument should be placed in an almost absolutely quiet spot, a separate room or a closet. A little thing like this does not seem to concern the company so much as it does the twenty cents that the victims are charged for a few minutes' torture at the machine. The little speaking box and ear trumpet are always placed in the noisiest part of the room, where the roar of the street is deafening, with a dozen or so instruments clicking away for dear life in close proximity and half as many messenger boys jabbering and skylarking around. The victim struggles, shouts, holds his breath, stops his ears and gets mad. It furnishes amusement for the messenger boys, though. When at last fragments of talk do float in, the Central Office takes unspeakable delight in "cutting it off." Then the victim has a chance to rest and get still madder.—*N. Y. Herald.*

On a New Battery, Called the Auto-Accumulator.

BY M. JABLOCHKOFF.

Having been for a long time occupied in searching for a simple and inexpensive voltaic battery, I first constructed one of which the combustible metal, which was sodium, was directly attacked by the oxygen of the atmosphere. This apparatus posessed advantages, but it had the defect that it was impossible to suspend its action unless by removing it from contact with the air.

I attempted at first to obviate this inconvenience by joining to the battery an accumulator for collecting the work but as this combination necessitated the simultaneous use of two apparatus, I succeeded in eliminating this complication by forming a new battery with three electrodes.

It comprises first an oxidizable metal which forms the first electrode; then a plate formed of a slightly oxidizable metal, such as lead, or of porous carbon capable of polarization, forming the second electrode, and lastly, another electrode formed of lamellæ, or tubes of very porous carbon immersed in air.

Among the various types employed I will describe only the most recent. It is composed of a flat vat of lead, or lined with lead, in which are placed fragments of the oxidizable metal, which may be sodium, sodium amalgam, zinc, iron, etc. When this metal is placed, the vat is filled up to its edge with any spongy matter, packing cloth, wood sawdust, etc.

Two cases may then occur: if we use sodium it is not necessary to introduce water, as the sodium becomes oxidized, forming caustic soda, which attracts moisture; if the metal employed is zinc or iron, the spongy mass is moistened with a solution containing either common salt, or, preferably, chloride of calcium, which attracts and retains moisture.

Lastly, upon the leveled spongy mass is placed a range of tubes of porous carbon. For this grouping I prefer to substitute for the leaden vat one of paraffined carbon.

The action set up in this battery is as follows: When the element is formed, but remains open, there are established local currents between the oxidizable metal and the electrode upon which it is placed. This latter is polarized and its potential rises until it has reached that of the metal; the action is then arrested or reduced to a minimum. If we wish to collect the exterior useful current, it is sufficient to connect by a conductor the electrode thus polarized to the other electrode of carbon; the discharge begins; the local currents resume their action and restore to the electrode its charge in proportion as it is expended.

The elements of this battery have been determined on several occasions and found as follows: The electromotive force depends on the oxidizable metal employed; with sodium amalgam it is 2.2 volts; with zinc, 1.6 volts; with iron, 1.1 volts.

The internal resistance of an element measuring 0.1 metre on its side varies between 0.25 ohm and 0.50 ohm, according to the thickness of the spongy layer and its degree of moisture.

The external dimensions are 0.1 metre in square by 0.025 metre in height; the weight is from 200 to 250 grms.

The advantages of this battery are its simplicity and convenience of manipulation. It is managed in this manner: the elements are ranged in batteries of a regular form and connected in groups of ten at most. The battery may be charged with oxidizable metals for several months, and it is merely necessary to renew the liquid from time to time. For that purpose we take a group of elements, steep it in pure water, withdraw it, let it drain and then steep it in a trough filled with a solution of chloride of calcium. This is taken up by the spongy body; the excess is poured away and the battery returned to its place.

This simple operation needs only to be performed very rarely if the battery is used for such work as bells, telegraphing, etc. If the current is employed for light or for mechanical power, the liquid must be renewed every 24 or 48 hours.

We may remark that this battery works only when its current is utilized, and that it gives off no odor.

It utilizes the local currents which are so injurious in ordinary batteries, and above all—

It yields electric energy very cheaply, as the metals are employed in the state of waste, filings, turnings, etc.

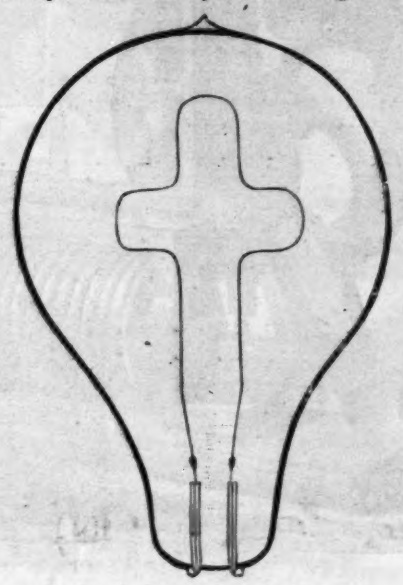
If we suppose that iron is used, it is known that to obtain one horse-power for an hour 850 grms. of metal must be consumed. But iron turnings are worth 0.05 franc per kilo, or for this quantity 0.04 franc. As for the chloride of calcium, it has no value.

We may therefore affirm that this battery gives the energy of one horse-power hourly for an outlay of 0.05 franc.—*Comptes Rendus.*

Notwithstanding the apparent advantage claimed by M. Jablochkoff, several of our English contemporaries express doubts as to its value on prolonged test. Thus the London *Electrical Review* says: We are at present making some experiments with this battery, constructed according to the inventor's description in *Comptes Rendus*, and when these are completed, which will be in a few days' time, we hope to be in a position to show that the "auto-accumulator" of M. Jablochkoff is no real advance in primary batteries.

The Lumley Incandescent System.

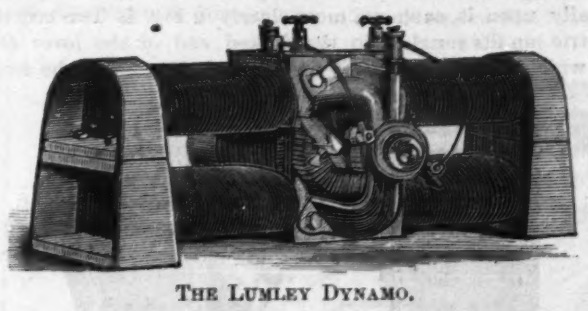
Among the electric light companies recently organized in this country is the Lumley Electric Light and Power



LUMLEY INCANDESCENT LAMP.

Supply Company, of this city, which has undertaken the manufacture of electric lighting machinery and appliances.

In the incandescent system employed by this company a lamp is used the filament of which has the shape shown



THE LUMLEY DYNAMO.

in Fig. 1. The substance from which this filament is made is a secret, and it is claimed that better results are obtained with it than from those heretofore employed. The lamps range from 10 to 300 candle-power.

The dynamo made by the company is illustrated in Fig. 2. This is a shunt-wound machine, the armature being a modified Gramme, with thirty-six sections.

A 75-light-machine, which we saw lately in operation at the works in Brooklyn, is designed as follows, according to the figures of Mr. C. L. Levey, the general manager:

Length of machine	2 feet 9 inches
Height of machine	1 foot 5 "
Width of machine	1 " 5 "
Length of armature	9 "
Resistance of armature	.79 ohm
Resistance of field	.78 "
E. M. F.	45 volts
Current	75 ampères
No. of revolutions per minute	1600

The 16-candle lamps have a resistance of 60 ohms, and consequently require three-fourths of an ampère to maintain them.

Development in the East.

Some of the latest items of electric lighting news will be found in the paragraphs below. The plants mentioned were all put in by the American Electric Manufacturing Company, which is rapidly extending its business.

The Poughkeepsie (N. Y.) plant is very nearly completed. The building, boilers, heaters and everything else are entirely new. The station will have a capacity of 114 arc lights, with room enough to double this, and for the installation of an Edison plant in connection with it. The dynamos and lamps will be placed in position this week, and will be ready for operation either the last of this or first of next week.

The Saratoga (N. Y.) plant, owned principally by the American company, will be started up either the last of this or first of next week, with a hundred lights. Arrangements are being made to install an Edison plant in connection with it, to furnish some of the hotels.

The Brookline (Mass.) Electric Light Company, the plant for which is now under construction by the American Company, will be ready to commence operations on the first of July. The capacity of the plant is 100 lights, and the company commences with a city contract for 50 street lights.

The Consolidated Electric Light Company of Maine, Portland, has now a steam capacity of 350 horse-power and engine capacity of 250 horse-power, and is operating 225 lights. The company, through its president, Hon. F. J. Rollins, and its general manager, F. A. Sawyer, on June 6 arranged for an increase of the plant to 300 lights capacity. The company already has 50 lights on the streets of Portland and has just received an order for 50 more. This is somewhat significant and looks favorable for harmonious relations between electric light and gas interests, especially so as the city of Portland owns very nearly one-half of the stock of the Portland Gas Company.

The Consolidated Electric Light Company of Maine, at Old Orchard Beach, is arranging to open and operate the central lighting station of the American system there. A formal transfer by the American Company will be made to the Consolidated, so that hereafter it will be operated by that company. The station has a capacity of 100 arc lights.

The electric light plant at Bar Harbor, Me., built by the American Company and run last year, was sold to the Lewiston & Auburn Electric Light Company, one of the subsidiaries of the American, and worked very successfully. The Lewiston & Auburn Company is increasing the capacity of the plant this year, and it is expected the station will be opened in a few days with a capacity of nearly 100 lights.

It is understood that satisfactory progress is being made by the American and Edison companies for the installation of a large central lighting station of the Edison system in Boston. It is expected it will be built with a capacity of from 10,000 to 15,000 lamps.

W. J. Jenks, for a long time with the Edison company, as manager of the Brockton (Mass.) plant, and in other capacities, has resigned his position with that company to become manager of the incandescent department of the American Company.

A New Automatic Electric Railway Signal.

We have recently had our attention drawn to a system of automatic electric railway signals, the working model of which was in operation. The system is a most ingenious one and belongs in the class of "block" signals, but obviates the necessity of having operators at each end.

The entire apparatus is inclosed within a case which is placed at the end of each block, and the system requires only one wire for its operation. At each block track connection is made, which closes a local circuit that transmits signals over the line to the posts beyond.

In the system of signals used, a train moving over a line protects itself both in front and in the rear automatically, and sends a signal to two posts beyond the one at which it is situated. From that point a signal is sent back to the first point beyond the train, and the signal is set at that point. Now, if the train ahead has not left the block, the signal will not be sent back, and when the train arrives at the post it will find the signal at danger. If the block is clear, however, the signal will be sent back and will set the disc at safety. In practical effect, the second post in advance notifies the first post in advance that it is safe for the train to proceed. In the same way, while signaling forward, the train also signals to the rear, and thus sets the signals for the train following. The mechanism includes a small motor for turning the signal disc, and the latter is fitted with an electric lamp which enables the trainmen to see it at night. This lamp at each post is in a normally open local lighting circuit, and is so connected that a current will be diverted through it, giving a light at the approach of a train. The switch by which the connections are controlled is operated by the movement of the signal mechanism. As soon as the train passes, however, the signal disc turns again, operates the switch and extinguishes the light. Thus the waste of electric energy is prevented and the lighting circuit being entirely local, any accident to it will not affect the operation of the main circuit. As stated before, the signals are all automatic, no clock-work being used. The motor, actuated by a current from a local battery, turns the signal disc in the proper direction.

The entire mechanism occupies a space of less than two cubic feet, and requires no delicate adjustment. The mechanism with the batteries could be incased within a suitable box at the block stations, and would only require the occasional services of a lineman to renew the batteries. While entirely automatic in its operation, the mechanism can be operated by hand, and thus in case of necessity a railroad employé provided with a key could set the instrument and transmit signals accordingly. Mr. W. T. Waters, of Atlanta, Ga., is the inventor of this ingenious apparatus.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER II.

ELECTRIC POTENTIAL.

POTENTIAL.—Potential, in the physical sense, is the power to accomplish work. It derives its specific name from the nature of the work; as *gravity* potential, *heat* potential, *electric* potential.

A pound weight raised to the height of ten feet has acquired ten foot-pounds of gravity potential, and has the power, if allowed to descend to the same level, of accomplishing ten foot-pounds of work, either in raising another weight, or setting machinery in motion by which work may be accomplished.

A mass of metal whose temperature has been raised from zero to 1,000 degrees, has acquired 1,000 degrees of heat potential, and can accomplish work to that amount in cooling to zero, either by heating another mass or generating steam by which machinery can be put in motion and work accomplished.

We have seen that bodies, when electrified, acquire the power to attract or repel other bodies. This power is called electric potential.

Suppose that the electric energy of the sealing wax in attracting the balanced rod, represented in Fig. 1, Chap. I., were just sufficient, if expended without loss, to move the rod one foot; and, in doing so, to overcome a resistance from inertia and friction represented by two ounces ($\frac{1}{8}$ pound); the electric potential of the sealing wax would equal $\frac{1}{8}$ of a foot-pound.

If only half this energy were required to overcome inertia and friction, the other half might be expended in lifting to a height of one foot an ounce weight attached to a thread fastened to the end of the rod, and passing over a pulley. In which case the work accomplished by this half would be represented by $\frac{1}{16}$ of a foot-pound.

Or the weight might be raised, or other work to the same amount accomplished, by putting in motion light machinery connected with rod by gearing at its centre, if the added friction were included in the ounce representing friction and inertia.

Repulsion would evidently have produced the same results in this case as attraction.

To distinguish between electricity and electric potential, we must bear in mind that electricity represents the energy itself, while potential represents certain relations between this energy and matter. Hence we derive the following definition:

Electric potential is the power which a body possesses to accomplish work by virtue of its electricity.

DIFFERENCE OF POTENTIAL.—To accomplish work in this way there must first be a difference of potential.

The descending weight could not raise the other weight unless there was a difference of level between them. The heated metal could not heat a similar mass unless there was a difference of temperature between them. Neither could the electrified sealing-wax attract the rod unless there was a difference of electric energy between them. And these phrases, difference of level, difference of temperature, difference of electric energy, are simply different forms of expression for difference of potential.

To produce this difference work must first be expended, and this work is the measure of the potential acquired.

The lifting of the pound weight ten feet against the force of gravity gave it the ten foot-pounds of gravity potential. The work of heating the metal, whether represented by combustion, by friction, or by concussion, gave it the 1,000 degrees of heat potential. And the rubbing of the sealing-wax gave it the $\frac{1}{16}$ of a foot-pound of electric potential.

As there is ordinarily no practical difference of electric potential between different points on the earth within a limited area, its potential is considered zero and taken as the base of all measurements of electric potential.

The qualification of this statement, as above, becomes necessary, since there are often great differences of potential over widely separated areas.

POSITIVE AND NEGATIVE.—Bodies whose potential is higher than that of the earth are said to have *positive* potential, while those whose potential is lower are said to have *negative*.

The potential of bodies is also considered positive or negative with reference to each other. If a body has a higher potential than the earth, but lower than that of another body, it is said to be positive with reference to the earth, but negative with reference to the other body. In like manner a body may have negative potential with reference to the earth, but positive with reference to another body of lower potential.

Hence, *positive and negative are merely convenient relative terms to designate different degrees of potential and not different kinds of electricity.*

The sign (+) is used to denote positive potential, and (—) to denote negative potential.

The earth's potential, then, is the electric zero, just as the freezing point is the zero of temperature in the centigrade thermometer, and all *uninsulated* bodies are said to be *connected with the earth*, and to have zero potential when not under special influence from insulated, electrified bodies in their vicinity.

When the electric potential of a body is changed from zero by an *increase* of its electricity it is said to be *positively* electrified; and when its potential is changed from zero by a *decrease*, it is said to be *negatively* electrified.

ELECTRIC MOVEMENT.—When a difference of electric potential exists between different bodies, or different parts of the same body, there is a constant tendency to equalization.

A state of equilibrium seems to be the natural condition of bodies, and to produce difference of potential requires, as we have seen, the exercise of force in the performance of work, by which this equilibrium is disturbed.

We find in other forms of energy, as gravity and heat, the same tendency to equilibrium, requiring the exercise of force to overcome it, as in the illustrations already given.

The restoration of equilibrium is always effected by a transfer of energy from the body having the greater to the one having the less energy; that is, from higher to lower potential.

In the case of gravity this transfer of energy carries the body with it, as in the descent of a weight or the movement of water from a higher to a lower level. But in the case of heat and electricity, the energy may move while the body remains stationary; and it may be transferred from one body to another, or from one part to another of the same body.

Thus the mass of metal, in the illustration given, transfers its heat energy to another mass; and in like manner, when a metal rod is heated at one end, the heat moves to the cold end.

There is this difference between gravity movement and heat movement, that while gravity can only move by carrying the body with it, heat moves through the body without producing change of position in its mass, like gravity.

A hot body transfers its heat to a cold one in its vicinity, but does not attract it; while gravity produces mutual attraction between all bodies, but is not transferred like heat from one body to another.

FIG. 4.—GOLD-LEAF ELECTROSCOPE.

But in electrified bodies we have both kinds of movement. Like heat, electricity can move from one body to another, or from one part to another of the same body; and, like gravity, it can carry the body with it.

Hence we must distinguish between the movement of electricity and the movement of the electrified body. Electric movement, like heat movement, is from higher to lower potential. If one part of a conductor be electrified, the electricity instantly distributes itself over every part. If two insulated bodies, free to move, are placed in each other's vicinity, like the pith-balls of the electroscope, the same tendency to equilibrium is shown by their mutual attraction.

Though only one ball be electrified, yet it is evident that their movement toward each other must be mutual, and in proportion to their mass, since action and reaction are equal, so that while the movement of the electricity is from the electrified to the non-electrified ball, that is, from higher to lower potential, the movement of the balls is mutual.

It will also be noticed that the movement of the non-electrified ball is opposite to that of the electricity. Hence, while electricity moves from higher to lower potential, bodies under its influence may move in either direction.

We have seen that when the two balls come into contact there is a transfer of electricity from the electrified to the non-electrified ball; equilibrium is established, and mutual repulsion follows, not only between the balls, but also between them and the electrified sealing-wax.

So long as a difference of potential exists there is mutual attraction; but when equilibrium is established, there is mutual repulsion. The same results may be produced by numerous similar experiments, in which different substances and different methods may be employed. Hence we deduce the following important principle:

Electrified bodies at different potentials attract, while those at the same potential repel each other.

There can be no repulsion unless there is a difference of potential between the electrified bodies and their surroundings. For if the surrounding bodies were at the same potential, the repulsion would be neutralized by their reaction. Hence, bodies at zero potential can show no repulsion. But in all cases of electrification there is a difference of potential created in the body, either above or below the original zero.

Indeed, attraction may account for the apparent mutual repulsion of bodies at the same potential, since this difference of potential between the electrified bodies and their surroundings must create attraction and tend to separate them.

But such outward attraction would not disprove the existence of repulsion, though it might account for some of its phenomena.

THE GOLD LEAF ELECTROSCOPE.—As our investigations now require a more sensitive instrument than any which has yet been described, we here introduce the Gold Leaf Electroscope.

The style represented at *A*, Fig. 4, is convenient, and easily constructed. It consists of a half-gallon tincture bottle, fitted with an ebonite stopper, through the centre of which passes a No. 8 brass rod, about 5 inches long, which terminates about $\frac{1}{4}$ of an inch above the stopper in a brass disc about 2 inches in diameter, having a round rim about $\frac{1}{16}$ of an inch in diameter projecting from its lower surface, as shown in enlarged section at *D*.

To the lower end of the rod is attached a thin cross-bar, about $\frac{1}{2}$ of an inch long, which will pass easily through the neck of the bottle. And from this cross bar are suspended two strips of imitation gold leaf, each $\frac{1}{4}$ of an inch wide by $2\frac{1}{2}$ inches long.

A small hole is drilled near the edge of the disc for convenience in attaching wires.

The leaves in this instrument lie close together, and, consequently, must always be electrified at the same potential; but in some experiments it is desirable to electrify them separately, and for this purpose a bottle with a wide neck is used, which will admit an ebonite stopper through which two rods can be inserted about an inch apart, and from the cross-bar of each a single leaf is suspended, the surfaces being parallel to each other. This style is represented at *B*, Fig. 4.

The rods can terminate above in balls, or be bent outward and terminate in discs.

Electroscopes may be constructed with thin metal discs, attached to the glass opposite the leaves; strips of the same material extending down and connecting with the earth.

Brass rods surmounted with balls are often used in the same way, as represented at *C*, Fig. 4. In which case a glass shade resting on a wooden base is more convenient than the bottle form.

The object in either case is to have conductors at zero potential near the leaves, which renders them more sensitive, and discharges them in case of too great divergence; thus preventing their adhesion to the glass, which is often troublesome. Annoyance from the latter cause is also obviated by using a bottle of globular form, the sides of which are too remote to be touched by the leaves.

A brass cap, covering the glass above, as shown at *C*, is also used to screen the leaves from external electric influence, and wire screens are likewise used for the same purpose.

The use of the bottle, or glass shade, is to protect the leaves from currents of air which would destroy them. And the ebonite stopper is for better insulation, since the glass generally used for bottles and shades is of inferior insulating quality.

The disc, or ball, and connecting-rod are for convenience in electrifying the leaves, which are the efficient part of the instrument.

The following experiment will illustrate its use: Let the electrified sealing-wax touch the disc of electroscope *A*; electricity is instantly transferred to the disc, rod and leaves, which are all good conductors, and the leaves, being free to move, and at the same potential, repel each other, and diverge.

If the disc now be touched with the finger, the electricity escapes to the earth, and the leaves, being reduced to zero, converge.

The sensitiveness of this instrument is so great that a chip of dry wood, less than a grain in weight, electrified in cutting, and dropped on the disc, produces divergence of the leaves.

A wooden pen-holder, electrified by striking it lightly on the table, produces the same effect.

Hence care must be observed to prevent the leaves from being torn by sudden, spasmodic movements; which are liable to occur when experimenting with highly electrified bodies in their vicinity.

MUTUAL EFFECTS OF FRICTION.—Thus far we have considered only the effect produced on the sealing-wax, glass, or other substance electrified by friction, without reference to the effect on the substance by which it was rubbed. But since action and reaction are equal, it is evident that these two effects must, in some way, equal each other; that electricity, or its equivalent in some other form of energy, must be produced on the rubber as well as on the substance rubbed.

To test this, let a piece of flannel, after being used to rub a stick of sealing-wax, touch the disc of electroscope *A*, Fig. 4, and the leaves will instantly diverge, showing that the flannel has been electrified.

Substitute silk, fur, or any other substance used as a rubber, and the same result will follow. Let the various substances rubbed be also tested, and it will be found that electrification has been produced on both rubber and substance rubbed, at the same time, by the same process.

Now let a rubber, about the same size as the sealing-wax, be prepared, by wrapping a stick in flannel and insulating one end with a piece of india-rubber tube.

Holding this rubber by the insulated end, let the sealing-wax be rubbed with it; and, keeping both still in contact, lay them carefully on the disc of the electroscope, so that

both shall touch it at the same instant, and no divergence of the leaves will occur. Now lift off the sealing-wax and they instantly diverge; replace it and they converge. Lift off the rubber and they diverge, replace it and they converge again.

Let the experiment be made with any other two substances used to generate electricity by friction, as silk and glass, ebonite and fur, and similar results will be obtained.

It will also be noticed that the approach of either electrified body while the other lies on the disc causes the leaves to converge, while its withdrawal produces divergence.

There is often a slight divergence of the leaves when both bodies are in contact on the disc, due to the difficulty of producing perfect adjustment of contact, and also to the fact that the electric condition of one body may change more rapidly than that of the other, from imperfect insulation or other cause.

The amount of divergence is also liable to vary; the removal of one body producing greater divergence than the removal of the other. This difference is also easily accounted for by difference of mass, of conductivity, or other cause.

Hence we deduce the following rule: *When electricity is generated on two bodies by their mutual friction, the electricity of each is neutralized by the presence of the other.*

The effect of the mutual friction of the two bodies is to create a difference of potential by the transfer of electric energy from one to the other. As one gains what the other loses, the amount of energy on the two is not changed so long as they remain in contact, and hence the potential of the electroscope is not disturbed.

But let one of the bodies be removed; suppose it to be the one to which energy has been transferred, the potential of the remaining body being negative, there is instantly a transfer of energy to it from the disc and leaves, which thus become negative also.

The leaves, being both at the same potential, diverge by mutual repulsion; and that potential being less than zero, the divergence is increased by attraction from the higher potential of the glass and surrounding objects.

Replacing this body, let the one *from* which energy has been transferred be removed; the potential of the remaining body being positive, there is instantly a transfer of energy *from* it to the disc and leaves, making them positive also. Hence the leaves diverge as before, from mutual repulsion, and the divergence is increased by attraction from the *lower* potential of the glass and surrounding objects.

From this it will be seen that the effect on the electroscope is the same whether the potential of the electrified body be positive or negative. In either case there is mutual repulsion between the leaves, from their being at the same potential; and mutual attraction between them and surrounding objects, caused by difference of potential.

The indications of the electroscope furnish no means of distinguishing between positive and negative potential; being the same for both. And as this is true of most of the phenomena pertaining to these two states, it is difficult, in static electricity especially, to determine which phenomena are positive and which negative.

There is no such well-marked distinction between them as between the positive and negative states known as heat and cold; neither can we observe electric movement as we can heat movement; since heat moves slowly, while electricity moves with inconceivable velocity.

But if we can show cause for an accumulation of electric energy at one point and for its absence at another, and show effects following such difference of energy, we then have proof of the positive and negative potential of the different points, which may be accepted as reliable.

Such proof will be furnished hereafter, and the further consideration of this question must be deferred till the examination of other phenomena shall enable the student to comprehend such proof.

CHARGE DEFINED.—The term *charge* is used to express the condition of an electrified body when its potential is above or below zero. If its potential has been raised above zero by receiving electricity, it is said to be *positively* charged; but if its potential has been reduced below zero by the removal of electricity, it is said to be *negatively* charged.

Hence we speak of a high negative charge in the same sense as we speak of intense cold, meaning an intensity of the negative condition caused by the absence of heat.

(TO BE CONTINUED.)

Incandescent Lighting on the Same Circuit with Arc Lighting.

Mr. W. M. Thomas, a young electrician of great promise, has during the past three years made a large number of novel inventions in electric lighting appliances, which have been duly patented, among which is a system by means of which arc and incandescent lamps are successfully run on the same circuit, and when from any cause a lamp or lamps in the circuit are broken or exhausted, no interruption occurs to the operation of the other lamps in the circuit, and the generator and motive power is immediately relieved to the extent of the energy required to operate the lamp or lamps, which are cut out of circuit. It is a well-known fact that incandescent lighting by means of a central station has not been practical on account of the enormous size of conductors required to convey the current, making it too expensive and cumbersome.

The Grand Rapids Electric Light and Power Company, with whom Mr. Thomas is associated, and who control all of the Thomas patents, have been operating with this system of lighting in Grand Rapids, Mich., for nearly two years. They not only supply hotels and stores with incandescent light, but also light the city, bridges and the fire-engine houses. They are now operating upward of sixty large incandescent lamps of from 150 to 400 candle-power each, besides a large number of 16 and 20 candle-power lamps, scattered along the whole length of their lines, with their arc lights. Until recently the Thomas system has not been placed upon the market, but now the Grand Rapids Electric Light and Power Company are manufacturing and introducing throughout this country their appliances for operating this system. The high candle-power lamps seem to be the most in demand, ranging from 150 to 300 candle-power, many mercantile establishments preferring them to the arc lamp which they take the place of.

The "De Redon" Call-Bell.

Our illustration represents a novel form of call-bell, which differs somewhat from other constructions. The object sought is to obtain compactness as well as efficiency, and this is accomplished by the use of a semi-circular spring which is fixed at its two ends. When the current passes through the bell it attracts the armature, to which one end of the spring is fixed, and the to-and-fro motion of the latter sets the spring in violent vibration. The knob attached to the spring thus strikes the inside of the bell and sounds it.

The contact-breaker is shown at the front, and requires no regulating screw after once being adjusted. It consists of a spring on the armature which bears against a contact post when no current passes. When the armature is attracted, the spring maintains contact until drawn off by

THE "DE REDON" CALL-BELL.

the small bent rod in front of it, which is also attached to the armature. This form of bell can be conveniently constructed in large sizes, and can be made to work with a very weak current, depending, of course, upon the thickness of the spring. The bell has lately been introduced by Messrs. Queen & Co., of Philadelphia.

Electricity in the Menagerie.

Nearly every day some new use is found for electricity, and one of the most recent applications of this power is in the interest of the professional tamers of wild animals, says an exchange. The inventor is a tamer himself and his instrument is an apparatus shaped like a stick and highly charged with electricity. When the animals become unruly he gives them shocks from this battery, and the effects are said to be instantaneous.

On experiment, three of his lions immediately showed signs of the greatest terror. They were seized with trembling and growled fitfully. The tiger was more quickly subdued, became stupefied and crouched in a corner of the cage. Bruin was more refractory to the electricity, which seemed scarcely to affect him. He would growl and show his teeth, but was subdued after repeated discharges.

The most astonishing effects, however, were perceptible in the boa constrictor. On receiving the discharge, the specimen from Cayenne, nearly twenty feet in length, became at once paralyzed, and remained motionless for six hours afterward. When he recovered he showed signs of helplessness for three whole days. Finally the elephant on being electrified by a touch of the stick upon the tip of his trunk, set up a series of wild cries, and became so frantic that the tamer feared he would break his heavy iron chain.

Magneto Telephones.

To the Editor of The Electrical World:

SIR: Will you please answer the following questions?: 1. How far will the magneto telephone work? 2. Will it work, using ground for return wire, by winding bobbins with fine wire? 3. What is the best proportion of permanent magnets and resistance of bobbins to get best results?

W. R. S.

OAK FOREST, Va.

ANSWER.—1. Over 100 miles. 2. Yes. 3. For full information on these points see "Practical Information for Telephonists," by T. D. Lockwood, to be had from this office, price $1.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, June 8, 1885.

The issuance of the Central Union Telephone Company's circular, giving notice that telephone contracts will be terminated in Indiana June 30, has brought the Overland Company to life again, as witness the following from the Indianapolis *Times*:

The recent threat of the Bell Telephone Company to remove its business from the State has caused the Overland Telephone Company, of this city, to come to the front. At a meeting it was decided to open negotiations with the Bell Company with a view of buying their plant in this city. Mr. N. S. Byram, the president, was instructed to write to the Bell Company and ascertain their price for the business here. If favorable terms cannot be arranged, a movement, it is said, is on foot to establish a new exchange. The Overland Company is taxed no royalty, and they claim to be able to operate telephones at $36 per year (the new rate) each and make money.

The Western Electric Manufacturing Company is made defendant in a bill filed in the United States Circuit Court by David Brooks, of Philadelphia, who asks for an accounting for royalties under an agreement for the use of insulators for telegraph wires made with him Dec. 6, 1876. He secured patents in 1864 and 1867 on the invention, and granted licenses to the defendant company and Eugene F. Phillips, of Providence, R. I., in 1876, to use the patent, which included paraffine as a medium. The licensees were to render quarterly accounts to him and pay him royalties in thirty days, which he says they did not do. He claims to have received only $300, instead of a share of the large profits made by the defendant company. He wants a decree for the sum due.

Messrs. Bailey & Ballou, representing the Thomson-Houston Electric Company, recently effected the organization of the Bloomington Electric Light and Power Company, at Bloomington. The company will start in with 100 arc lights. These gentlemen also sold 30 more lights to the Terre Haute E. L. and P. Co., making this plant number 109 lights.

The Indianapolis *Journal* of May 27 states that Superintendent McKenna, of the Jeffersonville, Madison & Indianapolis Railroad Company, is arranging with the Woolley Locomotive Electric Headlight Company to put light on his engines on the night runs.

I understand that the Woolley Headlight Company have purchased a piece of ground, and will proceed at once to erect a suitable manufactory.

The Indianapolis metropolitan police board are investigating the police telegraph and telephone systems of the several cities. One of the members visited Chicago during this week, and examined into the working of the system here. He reports in favor of its adoption in Indianapolis. The matter will be presented to city council next Monday evening.

The copartnership heretofore existing under the firm name of Lynch & Banta has been dissolved, and Col. S. C. Lynch announces that he will continue to buy and sell telephone stocks, bonds, local stocks, investment securities and transact a general brokerage business at his present location, 144 La Salle street. The Colonel's long connection with the Western Union and other telegraph companies, and later with the Western Electric Company, has made him well acquainted with the value and prospects of the different electrical enterprises, and peculiarly fits him for advantageously handling electrical stocks.

The Grand Rapids Electric Light and Power Company has now 210 subscribers. This company uses the Thomas arc and incandescent system. The Thomas arc lamp is quite simple and cuts out and in automatically, and is adaptable to any style of generator. The Thomas incandescent system, by means of which incandescent lamps can be operated on the same circuit with arc lamps safely and economically, has been in operation for nearly two years at Grand Rapids, and is now being introduced elsewhere.

Judge Blodgett has entered an order appointing Albert B. Chandler, the present receiver in New York, receiver of the Postal Telegraph Company in the State of Illinois, on filing an additional bond for $10,000. The court also ordered that Howell and the various marshals be restrained from advertising or selling the company's property.

The Railway Telegraph Supply Company is bringing out a new learner's telegraph instrument, which has many features to commend it to users. The instrument will be furnished at a moderate price, and with key and sounder on same base, or separate, as desired.

The Van Depoele Company is having quite a run on its small electric motors, of a size of one-half horse-power and less, for the use of dentists, jewelers, sewing-machine operators, etc. Motors up to one-half horse-power can be furnished, to be run with a battery.

Mr. Chas. D. Shain, formerly with the United States Electric Lighting Company, and lately appointed general Western agent for the Stanley incandescent system, has lately secured pleasant and convenient quarters in the new Home Insurance Building, La Salle and Adams streets, room 58. Mr. Shain has just returned from a trip East, and was successful in introducing some of his lights in Cincinnati. The Stanley lamp has produced a very favor-

able impression in the West, and the outlook for business Mr. Shain regards as exceedingly good.

Cincinnati is planning to do a large amount of granite and asphalt paving in the near future, and the matter of putting the electric wires underground is being brought forward by some of the papers as something which ought to be done before the new pavement goes down.

The following is the text of the Indiana telephone bill:

SECTION 1. Be it enacted by the General Assembly of the State of Indiana, that no individual, company or corporation, now or hereafter owning, controlling or operating any telephone line in operation in this State shall be allowed to charge, collect or receive as rental for the use of such telephones a sum exceeding $3 per month where one telephone only is rented by one individual, company or corporation. Where two or more telephones are rented by one individual, company or corporation, the rental per month for each telephone so rented shall not exceed $2.50 per month.

SEC. 2. Where any two cities or villages are connected by wire operated or owned by any individual, company or corporation, the price for the use of any telephone for the purpose of conversation between such cities and villages shall not exceed fifteen cents for the first five minutes, and for each additional five minutes no sum exceeding five cents shall be charged, collected or received.

SEC. 3. Any owner, operator, agent or other person who shall charge, collect or receive for the use of any telephone any sum in excess of the rates fixed by this act, shall be deemed guilty of a public offense, and on conviction shall be fined in any sum not exceeding $25.

It is safe to say that, if this law should be so construed as to allow of no charge by the company to the subscriber outside of the $3 per month mentioned, the enforcement of the law would close up a large majority of the telephone exchanges in the State.

THE TELEGRAPH.

Three Seconds.—The announcement of the result of the Derby race, on June 3, was transmitted from London, by the Direct United States Cable Company, to the Associated Press office in this city in exactly three seconds. This time beats the fastest on record by two seconds.

Death of James L. Shaw.—James L. Shaw, of Philadelphia, a well-known telegraph contractor and builder, died suddenly of apoplexy on the street, June 10. Mr. Shaw, who was 62 years of age, has been identified with various telegraph companies and was the contractor for the first telegraph line built between Washington and New Orleans.

Obituary.—George H. Frick, a prominent man in Baltimore, died June 10, aged about 58 years. He was formerly a prominent dry-goods merchant, and later established several lines of street railway, ramifying all the more prominent sections of the city. At one time he was manager of the Baltimore & Ohio Telegraph and Express, but gave it up to manage the street railways.

Electric Discharge.—A very able and interesting lecture was given on the 29th inst., before the Buffalo Electrical Society, by Prof. A. L. Arey, on "electric discharge," or the phenomena exhibited by electric currents in their passage through air and other gases in different degrees of rarefaction. The lecture was illustrated by a great many experiments, and was enjoyed by a large audience.

Messenger Boys Strike.—A dispatch from Chicago, dated Monday, the 8th inst., says: "All the messenger boys in the employ of the Baltimore & Ohio Telegraph Company went on a strike this morning with a view of compelling the company to reinstate Delivery Clerk Kelley, whose bond had been rejected by the company. The boys surrounded the offices, and created so much confusion that the police patrol was called to disperse them."

In the Canadian Northwest.—Superintendent Gisborne, of the Government telegraph line, was at Calgary when last heard from. He is going to the Rockies to arrange for a supply of cedar poles for the telegraph line which he is about to build between Moose Jaw and Woodhills. This will be the first import of timber from British Columbia by the Canadian Pacific Railway to the Northwest. The telegraph line is being constructed between Edmonton and Peace Hills by the military authorities.

Telegraphic Complications.—At Chicago, on the 5th inst., Judge Blodgett granted the Postal Telegraph Company an injunction restraining E. A. Howell, of Pennsylvania, from obtaining execution of a judgment of $61,266, the company representing that to sell any portion of its lines would seriously damage the entire property. In Philadelphia, on the 6th inst., J. S. Kurtz & Brother took judgment against the Bankers & Merchants' Telegraph Company for want of a sufficient affidavit of defense to a suit upon a note for $2,000. A judgment for $2,099.83 was entered and marked to the use of Edward S. Stokes.

The Wire's Delay.—At Louisville, Ky., on May 28, the Court of Appeals affirmed the decision of the lower court in the case of the Hon. Z. F. Smith against the Western Union Telegraph Company. Several years ago Smith went to New York to speculate in stocks. After being there a few days he was informed by a telegram from his home that his wife was sick. He deposited $17,000 with his broker in New York to invest for him, with instructions to telegraph him if there was a tendency for a fall in the market. The broker invested, and in a few days telegraphed Smith that there was likely to be a fall, and advised him to sell. The telegram was not delivered to Smith in time to save his money, and he lost all. In the lower court the judge gave special instructions to the jury, which then returned a special verdict, allowing Smith about $7,000. The judge thought the damages were too remote and only allowed Smith the sum of 75 cents, the cost of the telegram from New York. Smith then appealed, and the decision of the lower court must stand.

The Telegraph in Siam.—The Siamese Government, which is organizing its telegraph system upon the American plan, and will use the Morse alphabet, hired four American operators, who have recently sailed from San Francisco en route to Bangkok. They were selected after careful examinati n, and are intended not so much as routine operators as for instructors and organizers of local talent and material. All four took their wives and expect to be absent several years. They will be received upon arrival at Bangkok by the King and other high dignitaries. They are paid high salaries, besides all expenses, both traveling and while in Siam, and provision is made for their comfort in case of sickness.

Telegraph Consolidation.—A dispatch from Buffalo says the consolidation of the Bankers & Merchants' and Postal telegraph companies went into effect there on the 5th inst. The Postal Company controls the consolidation. Concerning this subject officers of the Postal Telegraph Company stated that a business arrangement had been entered into by that company and the Bankers & Merchants', providing that the active management of the last-named company shall be in the hands of the Postal. Although the two companies will maintain separate organizations, their various offices throughout the country will be consolidated so far as practicable. Unnecessary offices will be closed and some reductions in the force will be made.

THE TELEPHONE.

Judicious Liberality.—All the operators and book-keepers of the New England Telegraph and Telephone Company will be given a ten days' vacation under pay.

The Mexican Company's Progress.—The gross receipts of the Mexican Company have increased from $2,200 a month, a year ago, to $3,000, and the earnings appear to be capable of great expansion yet.

Telephone Patent Suit.—The National Improved Telephone Company and the Western Pennsylvania Telephone Company have entered suit in the United States Circuit Court, at Pittsburgh, Pa., against the Bell Telephone Company and the Central District and Printing Telegraph Company to restrain them from using the Blake transmitter, and to recover damages for an infringement on Blake's patent. It is the intention of the plaintiffs to institute similar proceedings in several other cities at once.

Mastering the Mysteries of a Telephone.—Lawyer Furman Sheppard, who has been explaining the mysteries of the telephone to the judges of the U. S. Court in Philadelphia, in the suit now pending there, seems to have the whole business at his tongue's end. It is said that one year ago, when he consented to act as one of the attorneys of the Clay Telephone Company, he had never spoken through a telephone; to-day he can actually make one, and is pronounced by some people one of the greatest living authorities on telephony.

Bell vs. Clay.—A dispatch of June 5 from Philadelphia says: Counsel for the American Bell Telephone Company to-day concluded the argument before Judge McKennan, in the United States Circuit Court, upon the application made on behalf of the company to have the Clay Commercial Telephone Company finally enjoined from using transmitters and receivers alleged to be infringements upon Alexander Graham Bell's patents. The court reserved its decision after stating that the findings of various circuits, already on record, establishing the validity of Mr. Bell's patent would not be disturbed.

Attacking Bell Interests.—A dispatch of June 4, from New Orleans, says: To-day, in the United States Circuit Court, before Judge Pardee, the National Improved Telephone Company, of Louisiana, instituted suit against the American Bell Telephone Company, of Boston, and its lessees in this State, the Great Southern Telephone and Telegraph Company. The suit is for infringement of the instruments of the National Improved Telephone Company for the transmission of speech by electricity, which consists in their using what is known as the Blake transmitter. The plaintiff company declare they will vigorously prosecute infringements of patents in any and all quarters, they claiming to own a large number of fundamental and older patents.

THE ELECTRIC LIGHT.

Cheap Lighting.—The proposition made by the Cosmopolitan Electric Telegraph and Telephone Company to light the old Philadelphia Park free of expense, has been accepted. The company will place six lights on the main drive and six others near the boat-houses.

On the New York Aqueduct Works.—As we predicted some time ago, the electric light has been called into service in the excavations for the New York aqueduct. A Schuyler plant has already been installed in shafts 9 and 11 A, and other circuits are to be run as the work advances.

In Geneva, N. Y.—On May 19, at their annual tax meeting, the citizens of Geneva voted overwhelmingly in favor of renewing the contract with the Brush Company for street lighting for the coming year. The contest between the gas and electric light interests has been a stubborn one, and the electric light has secured a brilliant victory through the efforts of Mr. E. M. Avery.

Middlesex Electric Light Company.—The treasurer of the above company, at Lowell, Mass., has submitted his report for the fiscal year ended May 31. The net earnings for the year were $11,497.90, or 8.7 per cent. on the shares issued, but no dividend was declared, the board of directors thinking the best interests of the company required the expenditure of this money in improving the plant.

Multifarious Activity.—The Edison Machine Works, New York City, in addition to their regular work, are contracting for other kinds of machinery. At present they are building a large number of hand rock drills, and are also building large vacuum pumps. They are manufacturing electric motors from one-half to three horse-power, and are completing the electric motors for trial on the elevated roads.

Without a Vacuum.—The statement comes from Boston that an inventor there has produced an incandescent lamp which will eventually revolutionize the present system of using glass globes, as this lamp does not require a vacuum, therefore a covering is not essential. The filament is composed of a platinum wire covered over with a non-combustible material which will expand and contract with the platinum wire, when heated, without cracking or peeling off.

Lively Lightning.—During a recent storm at Elmira, N. Y., the current came into the dynamo at the electric light station, and those who were present describe the monster as shooting up from the machine and spreading out like an umbrella. The electrician, C. W. Miller, C. M. Chase, John Haviland and J. S. Richards were in the dynamo-room, and were all unpleasantly affected, as well as alarmed. Chase was knocked down, and all were considerably weakened, being scarcely able to walk out. The damage at the station is estimated at about $400.

The Overhead System Sustained.—In Philadelphia, on June 1, the report of William Henry Rawle, as Master in the equity suit brought by the Board of Trade in the name of the Commonwealth against the Brush Electric Light Company, to compel that corporation to put its wires underground, was sustained by Court of Common Pleas No. 2 in a decision dismissing the exceptions thereto. Mr. Rawle decided as a scientific fact that no practicable underground system had yet been devised, and that a decision in favor of the complainants would embarrass the operations of the company.

National Electric Light Association.—A meeting of the Executive Committee of the National Electric Light Association was held in this city on Tuesday of this week. A general meeting of the association is to be held at the Union Square Hotel in this city on Tuesday, Aug. 18, at which a number of important papers are to be presented. All companies, firms or individuals owning or operating electric light plants are entitled to membership on payment of a fee of $10. Any one thus qualified and wishing to join should address the president, Mr. J. F. Morrison, general manager of the Brush Electric Light Company, Baltimore.

Vetoing the Electric Light in Philadelphia.—A veto of Mayor Smith, of Philadelphia, was sent in last Thursday, withholding his signature from the Thomson-Houston electric light ordinance. The Mayor considers the privileges granted are too great for an electric light company, and concludes by saying that "from and after the present time the executive position will best advance the welfare of our city, and protect and guard the lives of her citizens, and especially those who are officially compelled to brave the dangers incident to fire and its consequent risks, by the disapproval of all future legislation which will add to either the extension or perpetuation of the unsightly and dangerous electric services which incumber our streets."

The Michigan Capitol.—The Michigan Senate committees on State Capitol and on Appropriations and Finance have reported favorably the bill to light the Capitol with the incandescent electric light. The bill authorizes the Board of State Auditors to make the necessary contracts and to have the work completed by June 1, 1887. Mr. C. C. Cadman, of Detroit, has been of great service to the Legislature in illustrating the workings of the Edison light. The subject was not well understood, although the School for the Blind, in the vicinity of the State Capitol, has the Edison incandescent equipment of a capacity of 300 lights, as described recently in our columns. The House has also taken the preliminary steps to act upon the matter. The work, if authorized, can be speedily done, and if the Legislature should hold an extra session next year it can deliberate in an atmosphere unvitiated by the combustion of scores of burning jets of gas. The cost of gas for 1883-4 was $10,060.57, as reported by the Board of State Auditors.

APPLICATIONS OF POWER.

The Philadelphia Electric Railway.—The route of this road has been fixed. It will run along Elm avenue from the intersection of Belmont avenue to Fifty-second street, a distance of half a mile.

An Electric Submarine Boat.—Experiments are shortly to be made in Russia with an American submarine boat, which is to be driven by electricity. The boat is to be 28 feet long and have a speed of 10 knots, and is stated to be capable of traveling for a distance of 15 knots under water. It is to be manned by two men only, the captain and an electrician. The captain's position will be at the stern, where the apparatus for steering the boat is placed. The ventilation will be effected by compressed air. The mines are to be towed, and, in case of the boat being pursued, they can be discharged by electricity so as to blow up the enemy.

What is It?—A very ingenious contrivance is being affixed to a boat in Brooklyn and is said by a naval officer stationed at the Brooklyn Navy Yard to be adaptable to many other things besides serving to propel a boat for which it has been designed, and will soon be tried. The object of the experiment is to find out whether or not the feasibility of propelling a vessel for any length of time by electricity can be attained. The model on which the experiment is being made is shaped somewhat like a torpedo boat, and the batteries are in the centre of the vessel Great secrecy is being observed in all the movements of those concerned in her construction, and it is claimed that if they succeed, a vessel can carry fuel enough, in the shape of acids, to last her for a year without going into a port, doing away with the inconvenience of stopping at coaling stations, as steamers have to do at the present time.

MISCELLANEOUS NOTES.

Institute of Technology, Boston.—At the last meeting of the Hammer and Tongs Club of Mechanical and Electrical Engineers, held at Young's Hotel, May 29, the following officers were elected for the ensuing year: President, E. C Lufkin; Vice-President, John K. Burgess; Treasurer, Theodore Stebbins; Secretary, William M. Taylor.

Victims of Lightning.—Since 1835, the beginning of statistical enumeration of deaths by lightning in France, 4,609 cases have occurred, or a mean of about 100 per annum. The largest number occurred in 1874, when it reached 178; the smallest occurred in 1843, when 48 were recorded. Since 1854 care has been taken to distinguish between the sexes. Thus it has been

found that in thirty years 2,222 men and 929 women were killed by lightning.

New York Electrical Society.—The sixty-eighth meeting of this society will be held at its rooms, 234 Broadway, on Wednesday, June 10, at 8 P. M. Papers will be read on "The Electric Light from a Sanitary Point of View" and on the Phelps system of signaling to and from moving trains.

Electric Gas Lighters.—The Electric Gas-Lighting Company, of Boston, has made an arrangement with the Western Electric Company to manufacture its goods and sell them in New York City and the States of Illinois, Wisconsin and Minnesota. The Boston Electric Company has been made sole licensed agent for the burners in New England, and similar arrangements will be made for other localities. Mr. Burnham remains with the company as its business manager.

"The Novelties" at Philadelphia.—The applications for space in the Novelties Exhibition, which will be held in the Electrical Exhibition building by the Franklin Institute from Sept. 15 to Oct. 31, are coming in very rapidly. Already there are as many applications as there were exhibitors in the Electrical Exhibition, and it is proposed to accommodate about one thousand exhibitors. This is twice the number that were allotted space in the Electrical Exhibition. Larger facilities for room have been perfected, and the galleries, which were almost without any attraction at the Electrical Exhibition, will at the Novelties show be crowded with displays.

Reports of the Philadelphia Electrical Exhibition.—The Reports of the International Electrical Exhibition, when complete, will make an octavo volume of approximately 300 pages, elaborately illustrated. It is believed that it will constitute a valuable work of reference, while it will be interesting to many who are not specialists, and to the friends of the Institute, as the repository of the results of one of the most interesting exhibitions ever held in the United States. A limited number only of the Reports will be issued, and those desiring to receive a complete copy should send an order for the same, promptly, to the Actuary of the Franklin Institute.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

Plant at Auction.—William Kennelly, auctioneer, will sell at public auction, rolls, draw bench, hammers, tools and all the machinery of the late J. H. Muegge, deceased; also Marvin safe and Becker scales, on Tuesday, June 16, 1885, at 11 o'clock A. M., at 91 Liberty street, New York City. This sale is by order of Paul Schell, executor of G. H. Muegge, deceased. The machines and tools can be seen at 91 Liberty street on Monday, between 9 and 10, and on Tuesday at 10 A. M.

Electrical Apparatus.—The United States Electrical Company, of 43 Wall street, New York City, and 286 Fulton street, Brooklyn, are sole owners of patent No. 229,867, dated July 13, 1880, covering all extension bells, such as are used on magnetos and telephones. All manufacturers of magnetos and other systems of calls using extension bells were cautioned against their use in THE ELECTRICAL WORLD of May 30, 1885. They manufacture all kinds of surgical, medical and dental lights, and their pocket batteries are well made and the parts interchangeable. They also manufacture a large variety of other electrical goods, such as keys and sounders and general telegraph outfits.

Pocket Battery.—The Smith & Shaw closed cell pocket battery is a decided improvement in its line. The cell of hard rubber is hermetically sealed without a screw top, the zinc rod having a rubber head fitting tightly into the neck of the cell. The current can be graduated from the mildest to the strongest, and for private as well as professional medical purposes it meets every demand. The Smith & Shaw Electric Company, of 168 West Thirty-fourth street, this city, are the manufacturers.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations are as follows on the New York Stock Exchange, Boston Exchange and elsewhere:

Telegraph.—Am. Cable, b 60, a 61; Postal sixes, b 7⅛; Western Union, b 60¾, a 60⅝.

The Executive Committee of the Western Union Telegraph Company, on June 9, recommended the payment of a quarterly dividend of 1½ per cent. in July.

Telephone.—Am. Bell, b 184, a 185½; Erie, b 20⅝, a 20½; Mexican, b 1, a 1⅛; New England, b 31; Tropical, b 1¼.

The Boston *Herald* of June 6 says: Bell telephone rose, according to expectation, from 180½ to 189, falling back to 184. The defeat of the rental regulation bill caused the advance; free offerings probably the decline.

Electric Light.—Edison, b 50.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MAY 26, 1885.

Electric Signal Bell; Charles Henzel, New York, N. Y..... 318,472

Consists of the combination of a case inclosing and carrying the apparatus, and having an opening in one of its sides, the armature having a projecting stud or shoulder, the hinged frame having the quarter-circular slot, the loose pinion journaled in line with the hinged end of the frame and having a stud that enters the slot in the hinged frame, and the rack-bar that meshes with the loose pinion.

Telephone Exchange; John A. Seely, New York, N. Y..... 318,514

A conductor, the "manager's line," extends from each operator's table to the manager's table, and is provided at each end with a spring-jack and annunciator, thus enabling an operator, by connecting his line with the manager's line, to signal the manager, or the manager, by connecting a battery to his line, to call the operator. The manager's table is provided with a telephone in an electrical conductor terminating in a switch-plug, whereby the manager may loop his telephone directly into an operator's line by means of the spring-jack in said line which is at the manager's table. The manager's table is also provided with an additional

Fig. 1.

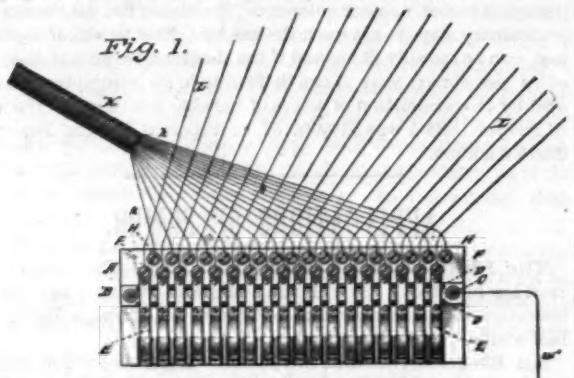


Fig. 2.

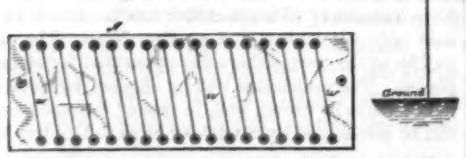
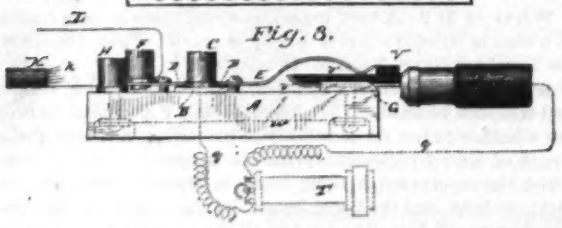


Fig. 3.



318,571. COMBINED LIGHTNING-ARRESTER AND TEST-CONNECTION.

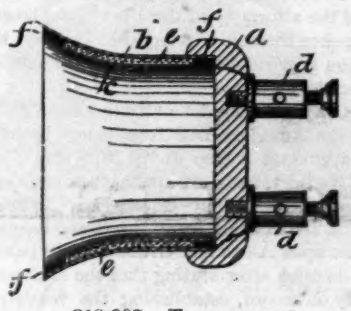
loop branch terminating in two switch-plugs, one of which normally connects with earth, whereby the manager may connect any two manager's lines together, or any one manager's line to earth. The manager's table is provided with a signaling-battery and two keys, whereby the manager may signal either of two operators who are connected by manager's lines, and each operator has a key and battery for signaling the manager over the operator's and manager's lines when connected, or for signaling a subscriber over the operator's and subscriber's lines when joined.

Combined Gas and Electric Light Fixture; C. Deavs, New York, N. Y., Assignor to the Archer & Pancoast Manufacturing Company, same place..... 318,547

The two parts of the fixture are united in one structure when assembled for use together, and they may be readily detached one from the other, or both used at one time, or both united, and one used independently of the other.

Combined Lightning-Arrester and Test-Connection; Henry B. Lytle, Boston, Mass., and John A. McCoy, Baltimore, Md..... 318,571

Fig. 1 is a front view in elevation of a combined lightning-arrester and series of test-connections constructed according to the invention. Fig. 2 is a rear view of the same. Fig. 3 is an end view, with a telephone shown in dotted lines as connected for testing. The letter *A* designates a base of non-conducting material, such as well-seasoned wood. Longitudinally upon the front face of this base is secured a strip *B* of metal, having a binding-screw *C* arranged upon one end. Upon the opposite front margins of the metal strip *B* are arranged thin, narrow, non-conducting slips *D D*, preferably of hard rubber or mica, and transversely upon these thin slips, and insulated thereby from the metallic strip *B*, are metal springs *E*, each having secured to one projecting end a binding screw *F*, while its other end is curved to bear upon a metal shoe *G*, secured to the base *A*. The shoes *G* are respectively connected with binding screws *H* by fine, easily-fusible wires *w*, extending across the back of the base.



318,907. TELEPHONE.

Electric Motor; Leonidas G. Woolley, Kalamazoo, Mich..... 318,589

Each magnet is provided upon the ends with curved projections for the purpose of increasing the length.

Electric Railway; Benson Bidwell, Philadelphia, Pa., Assignor of one-half to Charles F. Bidwell, Indianapolis, Ind..... 318,594

Consists of the combination, construction and arrangement of parts, having reference particularly to the provision of a line-circuit having branches or shunts, including an electric lamp, and cars or trains having an electromotor, circuit-connections to contact brushes located on and moving along the conductors or line-circuit, and which include a switch or circuit-breaker and a branch or shunt having an electric lamp for the cars.

Electric Alarm Clock; Victor Gallet, Brest, France (patented in France)..... 318,612

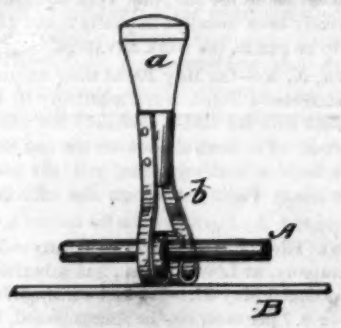
Adjustable terminals of an electric circuit are provided upon the face, so that they may be set at any hour for the hand or hands of a clock to close automatically.

Electric Bell; Augustus H. Palmer, Utica, N. Y..... 318,647

The back piece, stand and connecting bar are all made in one piece.

Armature for Dynamo-Electric Machines; D. A. Schuyler, New York, N. Y., Assignor to the Schuyler Electric Light Company of New York..... 318,664

Consists in connecting the same ends of diametrically opposite bobbins, or bobbins that are for the time being of opposite polarity to one another, while the remaining or free ends of said bobbins



318,929. CONNECTING DEVICE FOR SWITCH-BOARDS.

are connected one to a commutator-segment and the other to a common electrical joint, to which the remaining pairs of bobbins are connected in a similar way, the connections of successive pairs being, however, reversed, so that if two contiguous pairs of bobbins be taken the circuit for the current generated will be from a commutator-segment which is for the time being, say, positive, to a bobbin, to a diametrically opposite bobbin, to the common joint, to a third bobbin on the same side of the armature as the first-named bobbin, to a bobbin diametrically opposite the third bobbin, and to a negative commutator-segment.

Method of Operating Electric Railway Trains; Frank J. Sprague, New York, N. Y., Assignor to the Sprague Electric Railway and Motor Company..... 318,668

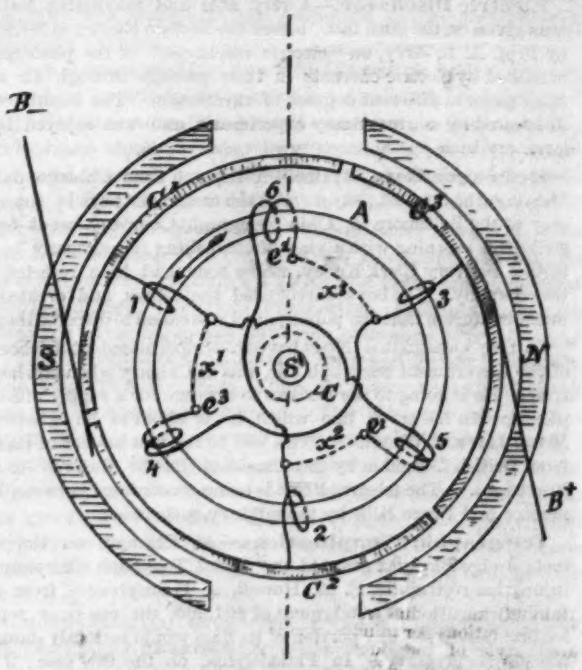
Consists of the method of slowing down or stopping an electric railway train, which consists in increasing the strength of the field-magnet of the motor propelling the train until the counter electromotive force of the armature exceeds the united electromotive force on the line, and then further increasing the said field-magnet strength to maintain the counter electromotive force above the initial as the speed of the train slackens.

Dynamo-Electric Machine; Addison G. Waterhouse, New York, N. Y., Assignor by mesne assignments to the Schuyler Electric Light Company, same place..... 318,671

The current enters on both plates C' and C^2. That which enters on C^2 passes around the nearly-neutral coil 2, thence across to coil 6, around it to end e^2, along wire X^3 to wire leading to coil 3, around this active coil to plate C^2, and out through brush $B+$. That which enters by plate C' passes through active coil 1, thence part of it goes across to active coil 5, thence to and around the inactive coil 6 on wire X^3 to active coil 3, to plate C^2, and out through $B+$. The other part, after leaving coil 1, crosses on X' to E^3, around active coil 4, across to and around coil 3 to C^2 and $B+$. As the armature A turns slightly around, the plate C^2 leaves the brush $B-$ and the neutral coil 2 is cut out. When plate C' alone is in contact with $B-$, the current all passes in through coil 1.

Secondary Battery; Joseph W. Swan, Laureston, Bromley, County of Kent, England (patented in England, Cape of Good Hope, India, Sweden, Victoria, South Australia, New Zealand, Natal, Norway, New South Wales, Denmark and Canada)..... 318,828

Consists of a support in the form of a plate with angular or



318,671. DYNAMO-ELECTRIC MACHINE.

equivalent holes, cells, or perforations extending through the same, and separated from one another by webs, walls, or partitions of uniform cross-section, the active material being placed in said cells.

Key and Sounder; Perley P. Belt, Columbus, Kansas. 318,854

The sounder is placed between the helices of the operating magnet and beneath the upper connecting bars of the helices.

Telephone; Jose D. Husbands, Valparaiso, Chili, Assignor to the American Bell Telephone Company, Boston, Mass. (patented in England)..... 318,907

Dispenses with the diaphragm, and so constructs the instrument that the mouth-piece itself, or a chamber connected therewith, forms the medium upon which the sound-waves act to produce the vibrations. Uses a tubular mouth-piece placed within a suitable chamber, containing a current-regulator, consisting of loose particles of finely-divided carbon *c*. The walls *b* of the chamber are of conducting material, and form one electrode. The tubular mouth-piece *c* is also of conducting material, and forms the second electrode; and the finely-divided conducting material is placed in position to form a variable resistance or tension regulator between the two electrodes.

Connecting Device for Switch-Boards; Elisha let W. Smith, Newark, N. J..... 318,929

As shown clearly in the cut, it consists of a contact device having a suitable handle and broadened spring bands secured thereto, the lower ends of said bands being turned in toward each other.